

**Jean Lafitte National Historical Park and Preserve- Barataria Unit: Inventory and
Monitoring Program for Amphibians and Reptiles**

Final Report

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Summary

1. From October 2001 to July 2002, we captured and observed 1504 amphibians and 1107 reptiles representing 16 species of amphibians and 32 species of reptiles at the Barataria Preserve of Jean Lafitte National Historical Park and Preserve.
2. In comparison with previous surveys, we increased the number of amphibians by 14% (from 14 to 16) and the number of reptiles by 63% (from 20 to 32). Some of this increase can be attributed to our use of a much wider array of capture methods that were used in prior studies, especially our use of various trapping methods (coverboards, turtle traps, and minnow traps).
3. Two amphibians (chorus frogs and bullfrogs) previously reported from the Preserve were not found during our surveys. Because of the limited duration of this study, we cannot conclude that these species are now absent from the Park.
4. Newts, green treefrogs, and bronze frogs made up the bulk of amphibian captures, each comprising 15-18% of the overall amphibian captures. The high abundance of newts makes them especially attractive for ecological studies.
5. Ground skinks were the most abundant reptile encountered, while green anoles and ribbon snakes were the next two most abundant.
6. Hand searching was the generally most effective sampling method with respect to abundance, ranking first for reptiles and second for amphibians. Hand searching also produced the best results for species richness, ranking first for both reptiles and amphibians. In addition, hand searching produced the largest number of unique species. Coverboards and minnow traps were the next most effective methods

7. Because the success of hand searching is highly dependent on the training and experience of the surveyor, its use for a monitoring program is problematic. The ease of use and relatively high effectiveness of coverboards and minnow traps makes them the recommended methods for monitoring reptile and amphibian populations at Jean Lafitte National Historical Park and Preserve.
8. Overall species richness was highest in cypress/tupelo swamps, intermediate in the hardwood forest, and lowest in the marsh habitats. Few amphibians or reptiles could be classified as habitat specialists.

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INTRODUCTION

In recent years, the emphasis in conservation biology has shifted away from protecting selected endangered or threatened species towards a broader appreciation for the need to preserve functional ecosystems. This approach, known popularly as biodiversity, has attracted considerable attention from both the academic and management communities (Grumbine 1994; Heyer et al. 1994; Wilson 1985, 1988). Currently, at least 18 federal laws potentially mandate federal agencies to maintain biological diversity (Anonymous 1992; Breininger et al. 1994). Such increasing emphasis on biodiversity makes reliable inventory and monitoring programs (hereafter I&M programs) of critical importance to land managers and federal and state resource agencies. Without detailed information on the distribution, habitat requirements, and abundance of native biotas, resource managers may only preserve that portion of the fauna which is highly visible or economically important (Bogan et al. 1988). Clearly, I&M programs are likely to be a high priority for resource managers over the next several years.

To a large degree, the National Park Service (NPS) has been at the forefront in the development of I&M programs for a variety of vertebrates, invertebrates, and plants. Indeed, the NPS has invested considerable time and effort in determining how to design and implement I&M programs (e.g., Anonymous 1990, 1992; Silsbee and Peterson 1991). However, even within the NPS system there is considerable variation among major groups of organisms in terms of the quality and quantity of data available from I&M studies. Based on data from the Southeastern Coastal Parks, the two groups of vertebrates for which the least I&M data are available are amphibians and reptiles; in

fact, the mean Biological Inventory Status scores for amphibians (11.2) and reptiles (10.4) are by far the worst for any of the vertebrate or plant groups in the Southeastern Coastal Parks (Stohlgren et al. 1994). The same situation occurs on the Jean Lafitte National Historical Park and Preserve (hereafter the Preserve), where there have been few quantified I&M studies conducted for amphibians and reptiles, and where the method employed for such studies were quite limited.

The lack of data on amphibians and reptiles at the Preserve is unfortunate, considering the increased attention these species are receiving from ecologists and resource managers. Most recent data show that reptiles and amphibians are important, perhaps critical, components of terrestrial and aquatic ecosystems (Gibbons 1988; Vitt et al. 1990). Because of their ectothermic physiology, amphibians and reptiles have extremely low energy requirements, and, consequently, may have a biomass that exceeds that of nearly all other vertebrates in aquatic and terrestrial ecosystems (Bennett and Gorman 1979; Burton and Likens 1975; Bury 1988; Bury et al. 1980; Pough 1980; Gibbons 1988; Vitt et al. 1990). Both groups are excellent indicator species of environmental degradation, amphibians because of their complex life cycle and permeable skin, and reptiles because of their frequent position as top carnivores (Duellman and Trueb 1986; Gibbons 1988; Vitt et al 1990). Amphibians and reptiles also have a surprisingly high economic potential; minimum wholesale values have been estimated at over \$35 million per year in Louisiana alone (Louisiana Dept. of Wildlife and Fisheries 1992), and the value of amphibians and reptiles imported into the U. S. exceeds \$400 million annually (Scott and Seigel 1992). These characteristics have led to increasing recognition of the need for collecting better data on the biodiversity and

ecology of amphibians and reptiles, both on the part of the academic community and by natural resource managers (Scott and Seigel 1992).

The location of the Preserve makes it especially interesting for I&M studies of amphibians and reptiles. Since the Preserve is located in close proximity to urban New Orleans, the herpetofauna of the Preserve has historically been impacted by high visitor usage, especially through collecting (D. Muth, pers. comm.). In addition, the location of the Preserve in proximity to brackish water estuaries (which have themselves been altered by humans) suggests that land-use changes outside the Preserve's boundaries might have a significant impact on amphibians and reptiles. These attributes make a quantified I&M program of very high basic and applied interest.

Goals and Objectives

The I&M program for amphibians and reptiles of Jean Lafitte National Preserve has the following major goals:

(1) **Inventory of herpetological communities:** The foremost goal of this study is to provide the NPS with an accurate and quantified inventory of the species of reptiles and amphibians present at the Jean Lafitte NP.

(2) **Identification of species-specific habitat requirements:** The second goal of this study is to determine the specific habitat requirements of reptiles and amphibians of the Jean Lafitte NP. This will provide the NPS with essential information on the impacts of various activities on herpetological communities, and will facilitate establishment of management programs for key species.

(3) **Develop a long-term monitoring program:** The final goal of this study is the establishment of a long-term monitoring program of reptiles and amphibians on selected units of the Jean Lafitte NP. Such a monitoring program will be modeled after the designs used at the Gulf Islands National Seashore and the Canaveral National Seashore (Seigel and Doody 1996).

Study Area

The Preserve is a 75 Km² wetland complex, and is located 24 km south of New Orleans, Louisiana. As outlined in White et al (1983), the Preserve is composed of four habitat types: freshwater marsh, intermediate marsh, cypress-tupelo swamps, and hardwood bottoms. Throughout the history of the Preserve, the land has been altered by man, in the form of canals, levees, clearing for habitation and agriculture and most recently, for oil exploration.

Freshwater and intermediate marsh comprise the majority the habitat of JLNHP (approximately 60%). Bulltongue (*Saggitara lancifolia*), arrow-head (*S. latifolia*), Cattail (*Typha sp.*) and wax myrtle (*Miraca cyraca*) are the dominant plant species. Bisecting the marsh are deep water canals (>1 m deep 10 m wide) which were created for transportation, flood control and logging (1800's-1900's) (D. Muth, pers. comm.). Adjacent to these canals are dikes, which support terrestrial plant life. Smaller canals cut into the marsh, called "Trenasses", were created during the 1920's for trapping and hunting purposes (D. Muth, pers. comm). Generally, trenasses are only 1m wide and 1.5 m deep, and lack any dike structure adjacent to them.

Cypress-tupelo swamps comprise approximately 20% of JLNHP. Dominant plant species in this ecological zone are: Bald cypress (*Taxodium distichum*), water tupelo (*Nyssa aquatica*), and chinese tallo (*Sapium seberifum*). Traversing this habitat are two natural bayous (or slow rivers), Bayou Coquille and Bayou des Familles. Until 2000 years ago, Bayou des Familles was a distributary of the Mississippi river and was responsible for significant sediment deposit in the area (D. Muth, pers. comm.).

The last habitat type is hardwood bottoms (hardwood forest), which composes about 20% of JLNHP. Dominant plant species in this community are: Live oak (*Quercus virginiana*), water oak (*Q. nigra*), and dwarf palmetto (*Sabal minor*). Signs of past human habitation, in the form of middens (shell piles), roads, ditches, and pecan plantations are common in this landscape. Natural swales and ephemeral ponds are also present in many areas.

A GPS-referenced list of specific survey sites within the Preserve is provided as Appendix I.

Materials and Methods

Collecting Methods

Coverboards

A total of seven arrays of 20 boards each (plywood and tin sheets, which measured 0.61m x 1.20m x 0.02 m) were placed in terrestrial habitats. These boards were generally checked at least once every other week, more often in warmer weather.

Aquatic Trapping

We utilized unbaited commercial minnow traps (Memphis Net and Twine Co.) to sample for snakes and amphibians in several aquatic habitats (e.g. cypress swamp, open marsh, swales, bayous, and man made ditches and canals). The minnow traps were modified by opening the mouth of the funnel slightly, and the hinges were tightened to decrease the gap between the two halves. Generally, minnow traps were set in arrays of 10 or 20 traps and were checked once or twice daily, depending upon weather conditions.

We also utilized baited hoop nets (Memphis Net and Twine Co.) to capture turtles. Hoop traps were of two sizes (0.46m and 0.91m). These hoop nets were baited with a variety of baits (e.g. turkey necks, cheese trimmings, and sardines) and placed in aquatic habitats. These traps were checked once daily during cooler weather and twice daily during warm weather.

Road Surveys

Driving the roads (or road surveys) in search of amphibians and reptiles were also conducted. We generally conducted road surveys in the early morning and late evening, particularly during times of rain. Any species of amphibians and reptiles that were found

were identified, measured and released; any animals found dead on the road (DOR) were preserved if in good condition.

Hand Searching

We also utilized a variety of active hand-searching search techniques. We utilized timed visual encounter surveys (during both the day and night). During this time, we would scan the ground, understory and canopy for any amphibians and reptiles. Additionally, we conducted hand hunting surveys, where we would walk through a habitat and flip all available cover in order to discover inactive amphibians and reptiles.

Data Recorded

Most reptiles and amphibians captured were identified and released at point of capture. In order to facilitate long-term monitoring, some individuals were given an individual mark. Snakes were marked by scale-clipping ventral scales (Brown and Parker 1976) and turtles marked by notching a small series of marks in the edge of the carapace (Ernst et al. 1974). Individuals given an individual mark were also measured (snout-vent length for snakes, carapace and plastron length for turtles), and weighed to the nearest 1.0 or 10.0 g. All animal care procedures follow the guidelines set up by the three major international herpetological associations and were approved by the Animal Care Committee of Southeastern Louisiana University.

Results and Discussion

Species Richness and Abundance

From October 2001 to July 2002, we captured and observed 1504 amphibians and 1107 reptiles representing 16 species of amphibians and 32 species of reptiles (Tables 1 and 2, Appendix III). This compares with 12 total species (three amphibians and nine reptiles reported by Smalley (1982) and 34 total species (14 amphibians and 20 reptiles) reported by Rossman and Demastes (1989). Thus, in comparison with previous surveys, we increased the number of amphibians by 14% (from 14 to 16) and the number of reptiles by 63% (from 20 to 32). Some of this increase can be attributed to our use of a much wider array of capture methods that were used in prior studies, especially our use of various trapping methods (coverboards, turtle traps, and minnow traps). Examples of “new” species found primarily in traps include lesser sirens, three-toed amphiumas, and alligator snapping turtles. However, hand collecting and road surveys also documented a number of species not found in prior surveys. Examples include spiny softshell turtles, cooters, green water snakes, and brown snakes. Why we found so many species not previously reported by other surveys is not known, but may have to do with a more intensive effort covering four seasons. However, we caution that any single-year study must be regarded as incomplete; Gibbons et al. (1995) documented how, even after 20 years of study, new amphibian and reptile species were still being found at the Savannah River Site in South Carolina. Thus, it is highly likely that even our inventory remains somewhat incomplete and that “new” species may still be found at the Preserve.

Two amphibians (chorus frogs and bullfrogs) previously reported from the Preserve were not found during our surveys. Because of the limited duration of this

study, we cannot conclude that these species are now absent from the Preserve. Declines of amphibians have been reported from other portions of the U. S., so we note that any follow-up studies should make a special effort to determine if the apparent absence of these two species was a short-term phenomenon or whether this might represent a real decline. (In June, 2003, W. Huslander of the NPS heard a bullfrog calling in the Preserve).

In terms of relative abundance, newts (*Notophthalmus viridescens*), green treefrogs (*Hyla cinerea*), and bronze frogs (*Rana clamitans*) and made up the bulk of amphibian captures, each comprising 15-18% of the overall amphibian captures (Table 3). The overall abundance of these species was not surprising, since Rossman and Demastes (1989) had commented that these all abundant amphibians in the Preserve. We concur with Rossman and Demastes (1989) that the high abundance of newts makes them especially attractive for ecological studies.

For reptiles, ground skinks (*Scincella lateralis*) were, by far, the most abundant reptile encountered (37% of total captures), while green anoles (*Anolis carolinensis*) and ribbon snakes (*Thamnophis proximus*) were the next two most abundant (9% and 8% of the captures, respectively; Table 4). Rossman and Demastes (1989) also found these three species to be especially abundant at the Preserve. However there was some substantial differences in the abundance of other reptiles between our survey and that of Rossman and Demastes (1989). For example, we found that green water snakes (53 records, 4.8% of total reptiles), copperheads (40 records, 3.6%), and cottonmouths (27 records, 2.4%) were all common to abundant in the Preserve. Conversely, Rossman and Demastes (1989) reported finding only five copperheads and three cottonmouths, and did not record

green water snakes at all. All three species were commonly found by hand, and well as via coverboards and minnow traps (for water snakes). We do not have a ready explanation for why these apparently abundant species were not located in higher numbers by Rossman and Demastes (1989).

Effectiveness of Sampling Methods

There has been considerable attention paid to assessing the effectiveness of various capture methods for inventory and monitoring amphibians and reptiles (e.g., Fitch 1992; Grant et al. 1992; Buech and Egeland 2002). Although there have attempts at standardizing methods (e.g., Heyer et al. [1994]), our experience has been that differences in habitat types, species composition, and logistical constraints (e.g., public interference) make attempts at standardization difficult. For example, our inventory of the herpetofauna of the Gulf Islands National Seashore (Seigel and Doody 1996) found that coverboards were a highly successful method for sampling lizards and salamanders. However, despite the presence of a number of lizard species, sampling at the Canaveral National Seashore with coverboards was ineffective (Seigel et al. 2002). On the other hand, road sampling was highly effective at Canaveral but ineffective at Gulf Islands. Thus, the sampling methods used for each site must, to a degree, be site specific.

At the Preserve, we found that hand searching was the generally most effective sampling method with respect to abundance, ranking first for reptiles (52% of all captures) and second for amphibians (32% of captures; Fig. 1). Hand searching also produced the best results for species richness, ranking first for both reptiles (87% of all species) and amphibians (88% of all species; Fig. 2). In addition, hand searching produced the largest number of unique species, i.e. species collected only by that method

(eight species). The success of other methods varied more widely between amphibians and reptiles. For example, whereas minnow traps were highly successful for amphibians (33% of all individuals and 41% of all species), they were less useful for reptiles, capturing only 2% of all individuals and 9.6% of all species (Figs. 1 and 2). The reverse was true for coverboards, especially for abundance; coverboards captured 37% of all individual reptiles but only 12% of all individual amphibians (Figs. 1 and 2). The success of road surveys was about equal between amphibians and reptiles, resulting in low numbers of individuals (4 and 5%, respectively), but fairly high numbers in terms of species richness (41.1 and 48.4%, respectively; Figs. 1-2). Turtle trapping proved to be the least productive, both in terms of abundance (2% of captures) and species diversity collected (13% of species collected). Additionally, no species were found exclusively using this method.

Although hand searching provided the greatest success, we caution that the use of this method is highly variable, depending largely on the skill and experience of the person(s) doing the surveys. Thus, use of hand searching for either the establishment of a monitoring program or comparison among studies is problematic. Because of their relative ease of use (little special training required) and relatively high effectiveness, we recommend coverboards and minnow traps as effective methods for monitoring reptile and amphibian populations at the Preserve. Although these methods will not be useful for some species, their relative lack of bias and ease of use make them strong candidates for future studies.

Habitat Associations

The habitat associations of the amphibians and reptiles of the Preserve are given in Tables 5 and 6. Eight of 16 amphibians (50%) and nine of 32 reptiles (28%) were found in all habitat types (freshwater and intermediate marsh, cypress-tupelo swamps and hardwood bottoms). Relatively few amphibians (smallmouth salamanders, greenhouse frogs, and pig frogs) were found in only one habitat, and of these, only the pig frog had a large enough sample size to rule out sampling bias. Twelve reptiles were found to be unique to a single habitat type (Table 6), but only two of these (painted turtles and box turtles) were captured often enough to rule out sample bias.

Overall species richness was highest in cypress-tupelo swamps (36 total species; 12 amphibians and 24 reptiles), intermediate in the hardwood forest (32 species; 13 amphibians and 19 reptiles), and lowest in the marsh habitats (27 species; 12 amphibians and 16 reptiles). However, we caution that these estimates are limited both by sampling duration and by the fact that some habitats (especially marshes) were more difficult to sample than others.

Conclusions

We captured and observed 1504 amphibians and 1107 reptiles representing 16 species of amphibians and 32 species of reptiles. In comparison with previous surveys, we increased the number of amphibians by 14% (from 14 to 16) and the number of reptiles by 63% (from 20 to 32). Some of this increase can be attributed to our use of a much wider array of capture methods that were used in prior studies, especially our use of various trapping methods (coverboards, turtle traps, and minnow traps). Two amphibians (chorus frogs and bullfrogs) previously reported from the Preserve were not found during our surveys. Because of the limited duration of this study, we cannot conclude that these species are now absent from the Park, but recommend that special efforts be made to survey for these species, as their continued absence might be part of a decline in amphibian species seen in other parts of the world.

Although any one-year inventory program must be regarded as incomplete, it is very likely that the 48 species of amphibians and reptiles found during our study (plus those of previous surveys) now represents 85-90% or more of the herpetofauna of the Preserve. In their comprehensive text on Louisiana's herpetofauna, Dundee and Rossman (1989) indicated that 21 amphibians and 38 reptiles are present in the parishes in the immediate vicinity of the Preserve, although not necessarily in the habitat types found in the Preserve. Of these, 18 of 21 potential species of amphibians (85.7%) and 32 of 38 reptiles (84.2%) have now been found at the Preserve. The list of these potential elements of the Preserve's herpetofauna are listed in Appendix II.

As is true of most inventory and monitoring studies, we found major differences between sampling methods, with hand searching, coverboards, and minnow traps

producing the best results. However, given that the success of hand searching is highly dependent on the ability of the investigator, we do not recommend this method for developing a monitoring program at the Preserve. Conversely, the ease of use and relatively high effectiveness of coverboards and minnow traps makes them the recommended methods for monitoring reptile and amphibian populations at the Preserve.

Given the proximity of the Preserve to a growing suburban environment, it is highly likely that there will be impacts on amphibians and reptiles, especially as a result of human collecting and invasion of the Preserve by feral cats and other domestic animals. To date, we have documented several of these activities occurring in the Preserve; one of our coverboard arrays was disturbed in a fashion consistent with collection of snakes. On another occasion, a law enforcement officer have reported to one of us (NJA.), his finding of 21 “jug-lines” set for alligator snapping turtles. There were several snapping turtles on the lines. The potential for these activities to impact natural populations of reptiles and amphibians can be severe. Thus, we strongly encourage the implementation of a monitoring program for amphibians and reptiles, so any changes in the status of these species can be detected early enough for proper management steps to be taken.

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Figure 1. Comparison of success rate of different sampling methods for species abundance of amphibians and reptiles

Figure 2. Comparison of success rate of different sampling methods for species richness of amphibians and reptiles

Table 1. Current inventory of amphibians at Jean Lafitte National Historical Park and Preserve. Data collected from 2001 to 2002 are compared to prior inventories by Smalley (1982) and Rossman and Demastes (1989). Species marked with an “*” have a voucher specimen deposited at the LSU Museum of Zoology.

Common Name	Latin Name	Smalley	Rossman and Demastes	This study
*Smallmouth salamander	<i>Ambystoma texanum</i>	-	-	+
*Three toed amphiuma	<i>Amphiuma tridactylum</i>	-	-	+
Dwarf salamander	<i>Eurycea quadridigitata</i>	-	+	+
Newt	<i>Notophthalmus viridescens</i>	-	+	+
*Lesser siren	<i>Siren intermedia</i>	-	-	+
Cricket frog	<i>Acris crepitans</i>	-	+	+
*Gulf coast toad	<i>Bufo nebulifer</i>	+	+	+
*Greenhouse frog	<i>Eleutherodactylus planirostris</i>	-	-	+
Narrowmouth toad	<i>Gastrophryne carolinensis</i>	-	+	+
Bird Voiced treefrog	<i>Hyla avivoca</i>	-	+	+
*Green treefrog	<i>Hyla cinerea</i>	-	+	+
Squirrel treefrog	<i>Hyla squirella</i>	-	+	+
Spring peeper	<i>Psudacris crucifer</i>	-	+	+
Chorus frog	<i>Psudacris triseriata</i>	-	+	-
Bullfrog	<i>Rana catesbiana</i>	+	+	-
Bronze frog	<i>Rana clamitans</i>	-	+	+
*Pig Frog	<i>Rana grylio</i>	-	+	+
Southern Leopard frog	<i>Rana utricularia</i>	+	+	+

Table 2. Current inventory of reptiles at the Preserve. Data collected from 2001 to 2002 are compared to prior inventories by Smalley (1982) and Rossman and Demastes (1989). Species marked with an “*” have a voucher specimen deposited at the LSU Museum of Zoology.

Common Name	Latin Name	Smalley	Rossman and Demastes	This study
Spiny softshell turtle	<i>Apalone spinifera</i>	-	-	+
Common snapping turtle	<i>Chelydra serpentina</i>	-	-	+
Southern painted turtle	<i>Chrysemys picta</i>	-	+	+
Mud turtle	<i>Kinosternon subrubrum</i>	?	+	+
Alligator snapping turtle	<i>Macrolemys temminckii</i>	-	-	+
Cooter	<i>Psudemys concinna</i>	-	-	+
Stinkpot	<i>Sternotherus odoratus</i>	?	+	+
Gulf coast box turtle	<i>Terrepenne carolina</i>	+	+	+
Red eared slider	<i>Trachemys scripta</i>	+	+	+
Green anole	<i>Anolis carolinensis</i>	+	+	+
Five lined skink	<i>Eumeces fasciatus</i>	-	+	+
*Mediterranean gecko	<i>Hemidactylus turcicus</i>	-	-	+
Ground skink	<i>Scincella lateralis</i>	+	+	+
*Copperhead	<i>Agkistrodon contortrix</i>	-	+	+
Cottonmouth	<i>Agkistrodon piscivorous</i>	+	+	+
*Black masked racer	<i>Coluber constrictor</i>	+	+	+
Canebrake rattlesnake	<i>Crotalus horridus</i>	-	-	+
*Black ratsnake	<i>Elaphe obsoleta</i>	-	-	+
*Gray ratsnake	<i>Elaphe spilotes**</i>	-	-	+
*Mud snake	<i>Farancia abacura</i>	-	+	+
Speckled kingsnake	<i>Lampropeltis getulus</i>	-	+	+
Louisiana milk snake	<i>Lampropeltis triangulum</i>	-	+	+
*Green watersnake	<i>Nerodia cyclopion</i>	-	-	+
Plainbellied watersnake	<i>Nerodia erythrogaster</i>	-	-	+
*Banded watersnake	<i>Nerodia fasciata</i>	+	+	+
Diamondback watersnake	<i>Nerodia rhombifer</i>	-	+	+
Rough Green snake	<i>Opheodrys aestivus</i>	-	+	+
Glossy crayfish snake	<i>Regina rigida</i>	-	+	+

Common Name	Latin Name	Smalley	Rossman and Demastes	This study
Western ribbon snake	<i>Thamnophis proximus</i>	+	+	+
Common garter snake	<i>Thamnophis sirtalis</i>	-	-	+
Alligator	<i>Alligator mississippiensis</i>	+	+	+

Table 3. Relative abundance of amphibians at Jean Lafitte National Historical Park and Preserve, broken down by capture method.

Common name	Hand	Road	Minnow Trap	Turtle Trap	Coverboard	Calling	Total	Percent
Smallmouth salamander	0	1	0	0	0	0	1	0.07
Three toed amphiuma	1	0	8	1	0	0	10	0.66
Dwarf salamander	1	0	0	0	6	0	7	0.47
Newt	31	1	251	0	1	0	284	18.88
Lesser siren	1	0	14	0	0	0	15	1.00
Cricket frog	54	1	0	0	1	58	114	7.58
Gulf coast toad	22	5	0	0	13	10	50	3.32
Greenhouse frog	1	0	0	0	0	0	1	0.07
Narrowmouth toad	25	0	0	0	45	26	96	6.38
Bird Voiced treefrog	2	0	0	0	0	35	37	2.46
Green treefrog	161	34	0	0	3	25	223	14.83
Squirrel treefrog	58	0	0	0	2	12	72	4.79
Spring peeper	1	0	0	0	0	37	38	2.53
Bronze frog	87	13	15	0	110	49	274	18.22
Pig Frog	15	0	29	0	0	18	62	4.12
Southern Leopard frog	17	2	5	0	0	27	51	3.39
Ranid tadpoles	0	0	169	0	0		169	11.24
TOTAL	477	57	491	1	181	297	1504	100

Table 4. Relative abundance of reptiles at Jean Lafitte National Historical Park and Preserve, broken down by capture method.

Common name	Hand	Road	Minnow Trap	Turtle Trap	Coverboard	Total	Percent
Spiny softshell turtle	3	0				3	0.27
Common snapping turtle	0	1				1	0.09
Southern painted turtle	52	0		1		53	4.79
Mud turtle	14	3		0		17	1.54
Alligator snapping turtle	1	0		1		2	0.18
Cooter	61	0		0		61	5.51
Stinkpot	1	0		1		2	0.18
Gulf coast box turtle	14	1		0		15	1.36
Red eared slider	30	1		26		57	5.15
Green anole	66	0			38	104	9.39
Five lined skink	15	0			10	25	2.26
Mediterranean gecko	2	0				2	0.18
Ground skink	78	0			328	406	36.68
Copperhead	27	4			9	40	3.61
Cottonmouth	27	0				27	2.44
Black masked racer	12	14			2	28	2.53
Canebrake rattlesnake	0	1				1	0.09
Black ratsnake	2	5			3	10	0.90
Gray ratsnake	0	0				0	0.00
Mud snake	1	4				5	0.45
Speckled Kingsnake	0	1				1	0.09
Louisiana milk snake	2	0			1	3	0.27
Green watersnake	34	0	19			53	4.79
Plainbellied watersnake	2	1				3	0.27
Banded watersnake	51	5	2		3	61	5.51
Diamondback watersnake	2	0				2	0.18
Rough Green snake	1	0				1	0.09
Brown snake	3	3			1	7	0.63
Western ribbon snake	59	14			11	84	7.59
Common garter snake	3	0				3	0.27
Glossy crawfish snake	0	1	1			2	0.18
Alligator	14	1		13		28	2.53
Total	577	59	22	42	406	1107	100.00

Table 5. Habitat associations of amphibians at Jean Lafitte National Historical Park and Preserve. Presence is noted by a “+” and restricted distribution by a “*”.

Common name	Hardwood bottoms	Cypress-tupelo Swamp	Marsh
Smallmouth salamander	*		
Three toed amphiuma	*	+	+
Dwarf salamander	+		*
Newt	+	+	+
Lesser siren		+	+
Cricket frog	+	+	+
Gulf coast toad	+	+	+
Greenhouse frog	*		
Narrowmouth toad	+	+	+
Bird Voiced treefrog	+	+	
Green treefrog	+	+	+
Squirrel treefrog	+	+	*
Spring peeper	+	+	
Bronze frog	+	+	+
Pig Frog			+
Southern Leopard frog		+	+

Table 6. Habitat associations of Reptiles at Jean Lafitte National Historical Park and Preserve. Presence is noted by a “+” and restricted distribution by a “*”.

Common name	Hardwood bottoms	Cypress-tupelo Swamp	Marsh
Spiny softshell turtle		*	
Common snapping turtle		*	
Southern painted turtle		+	
Mud turtle	+	+	
Alligator snapping turtle		+	
Cooter		+	
Stinkpot		*	*
Gulf coast box turtle	+		
Red eared slider		+	*
Green anole	+	+	+
Five lined skink	+	+	*
Mediterranean gecko	*		
Ground skink	+	+	*
Copperhead	+	*	
Cottonmouth	+	+	+
Black masked racer	+	+	+
Canebrake rattlesnake	*		
Black ratsnake	+	+	*
Gray ratsnake	*	*	*
Mud snake		+	
Speckled Kingsnake	*		
Louisiana milk snake	+	+	
Green watersnake		*	+
Plainbellied watersnake	+		
Banded watersnake	+	+	+
Diamondback watersnake			*
Rough Green snake			*
Brown snake	+	+	*
Western ribbon snake	+	+	+
Common garter snake	*		
Glossy crawfish snake		*	
Alligator		+	+

Appendix I. List of specific survey sites used in this study with GPS coordinates.

Site Name	Site Use	UTM Coordinates (North/East)
Fallen Oak Marsh	Minnow Traps	N: 3301313.105; E: 777612.94, NAD 83
Fuller's Trenass	Turtle, minnow trapping, coverboards	N: 3301371.14, E:777074.58 NAD 83
Hwy 45 at Bayou Coquille	Road Cruising	N: 3299451; E: 0778214, 15R
Barataria Swale	Minnow trapping	N; 3298227; E: 0780030, 15R
Wood duck ponds	Minnow trapping	N: 3298796; E: 0780186, 15R
Ring Levee	Hand captures	N: 32998792, E: 0780184, 15R
Greenhouse frog locality	Hand captures	N: 3298752, E: 0779119, 15R
Upper bayou des Familles	Turtle, minnow trapping	N: 3298640.47, E: 778937.47, 15 R
Hwy. 45 @ Twin canals	Road cruising	N: 3300646, E: 077856, 15R
Fuller's Trenass site II	Minnow trapping	N: 3301307.85, E: 777125.47, 15R
Educ. Center parking lot	Hand captures	N: 3298412, E: 0779268, 15R
Ring Levee	Coverboards	N: 3298838, E: 0779635, 15R
Palmetto trail	Coverboards	N: 3298869, E: 0779541, 15R
Behind Educ. Center	Coverboards	N: 3298669, E: 0779216, 15R
Visitor Center	Coverboards	N: 3298252, E: 0778947, 15R
Lower Kenta	Coverboards	N: 3298920, E: 0777511, 15R
Upper Kenta	Coverboards	N: 3301211, E: 777535
Twin canals	Coverboards	N: 3300569, E: 0778508, 15R
Marsh pond	Turtle trapping	N: 3298758, E: 776470
Ring Levee Pond	Minnow trapping	N: 3298582, E: 0780200

Appendix II. Species of amphibians and reptiles that could potentially be found on the Preserve (based on distribution maps in Dundee and Rossman, 1988), but which have not been found as of this writing.

Common Name	Latin name	Comments
Southern dusky salamander	<i>Desmognathus fuscus</i>	Many records south of Lake Pontchartrain. Habitat may not be appropriate.
Woodhouse's toad	<i>Bufo woodhousei</i>	Many records south of Lake Pontchartrain. Something of a puzzle, as this is a common toad in many places.
Gray treefrog	<i>Hyla chrysocelis-versicolor</i>	A few records, mainly west of the Preserve. Call is highly conspicuous, so unlikely to be missed.
Mississippi map turtle	<i>Graptemys kohnii</i>	A few records south of Lake Pontchartrain, but habitat may be inappropriate
Diamondback terrapin	<i>Malaclemys terrapin</i>	Possible in brackish portions of the marsh.
Broad-headed skink	<i>Eumeces laticeps</i>	Some records south of Lake Pontchartrain. Could be confused with five-lined skinks
Ringneck snake	<i>Diadophis punctatus</i>	A few records south of Lake Pontchartrain, but habitat may be inappropriate
Hognose snake	<i>Heterodon platirhinos</i>	A number of records south of Lake Pontchartrain, but habitat may be inappropriate
Pygmy rattlesnake	<i>Sistrurus miliarius</i>	A number of records south of Lake Pontchartrain. A difficult snake to survey for, could be present.

Appendix III. Annotated species accounts of all amphibians and reptiles found on the Preserve during this study.

Smallmouth Salamander (*Ambystoma texanum*)

DESCRIPTION: A relatively small (2-3 in.), stocky salamander with a narrow head. Ground color generally black or dark brown. There may be small light flecks on the body and limbs. See Conant and Collins (1991; plate 38, pp. 252).

SIMILAR SPECIES: Of the other salamanders found at the Preserve, none can be confused with this species. Sirens and amphiumas are eel-like in appearance, dwarf salamanders are extremely slender with dark stripes, and red-spotted newts are brown with distinct spots.

HABITATS FOUND: Hardwood forest only.

ABUNDANCE AND HABITS: One of the most rarest amphibians in the Preserve in our surveys, found only once (on the road) and not at all by either Smalley (1982) or Rossman and Demastes (1989).

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	----
MINNOW TRAPS	----
COVERBOARDS	----
ROAD	LOW

COMMENTS: A targeted survey for this amphibian needs to be conducted. Techniques likely to reveal its presence would be dip netting in vernal pools in the hardwood forests. Additionally, drift fences could be created along the edge of these pools and both pitfall traps and funnel traps utilized to capture adults during breeding events.

Three-toed Amphiuma (*Amphiuma tridactylum*)

DESCRIPTION: A very large (up to 3 ft.) eel-like salamander. Bi-colored; dorsum is brown, grey, purplish, or black; venter is gray and distinctly lighter than the dorsum. Legs reduced, each with three tiny toes. No external gills. See Conant and Collins (1991; plate 37, pp. 245).

SIMILAR SPECIES: Lesser sirens (*Siren intermedia*) are extremely similar in appearance. However sirens have conspicuous external gills and lack hindlimbs.

HABITATS FOUND: Primarily Cypress/tupelo swamp and marsh, restricted in hardwood forest to aquatic habitats.

ABUNDANCE AND HABITS: Chiefly nocturnal and captured mainly in minnow traps. Aquatic as larvae and adults, amphiumas become active after rains, usually at night, when they ambush crayfish, frogs, and a variety of invertebrates. During the day (except in heavy downpours) amphiumas reside in crayfish burrows or self-made burrows in soft mud under water.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	LOW
MINNOW TRAPS	HIGH
TURTLE TRAPS	LOW
COVERBOARDS	----
ROAD	----

COMMENTS: One of the largest salamanders in the United States.

Dwarf salamander (*Eurycea quadridigitata*)

DESCRIPTION: A very small (2 inches), slender salamander with very small legs and distinct dark stripes on a yellow background. The dwarf salamander has only four toes on each of its back feet. This is one of the smallest vertebrates in North America, with a body mass of less than one gram. See Conant and Collins (1991; plate 43, pp. 294).

SIMILAR SPECIES: Of the other salamanders found at the Preserve, none can be confused with this species. Sirens and amphiumas are eel-like in appearance, smallmouth salamanders are black without dark spots, and red-spotted newts are brown with distinct spots.

HABITATS FOUND: Hardwood forest; restricted in the marsh to terrestrial habitats.

ABUNDANCE AND HABITS: A rather uncommon salamander, seen only on seven occasions, almost always under coverboards in the hardwood forest. They can be quite abundant in other parts of the range, but their small size makes detection difficult.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	LOW
MINNOW TRAPS	----
COVERBOARDS	HIGH
ROAD	----

COMMENTS: Like other species of the family Plethodontidae, this salamander lacks lungs. Respiration occurs solely across the surface of its skin and the lining of the mouth.

Red-spotted Newt (*Notophthalmus viridescens*)

DESCRIPTION: A relatively small (2-3 in.) salamander. Color greenish to brown, flecked with black spots throughout, sometimes with paired red spots down each side of the back. Skin is smooth and wet, except in the "eft" stage. At JELA, the dry skin of the eft is generally brown with orange spots; at other sites they may be orange, orange-brown, or brown. Males have a dorsolaterally flattened tail during the breeding season. See Conant and Collins (1991; plate 39, pp. 257).

SIMILAR SPECIES: Of the other salamanders found at the Preserve, none can be confused with this species. Sirens and amphiumas are eel-like in appearance, smallmouth salamanders are black without dark spots, and dwarf salamanders are extremely slender with dark stripes.

HABITATS FOUND: Found in and near aquatic habitats throughout the Preserve.

ABUNDANCE AND HABITS: One of the most abundant and widely distributed amphibians in the park; easily captured in minnow traps in a variety of aquatic habitats. Aquatic as larvae and adults, but with a terrestrial "eft" stage. Efts can be found under logs and leaf litter, where they forage for insects. Larval and adult newts feed on insects, tadpoles, and salamander larvae.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	MODERATE (efts)
MINNOW TRAPS	HIGH (newts)
COVERBOARDS	LOW
ROAD	LOW

Lesser Siren (*Siren intermedia*)

DESCRIPTION: A moderately large (up to 1.5 ft.) eel-like salamander. Color generally black to dark gray; generally dark spots are visible. Some specimens may have distinct yellow flecks along the sides. Venter usually a little lighter than the dorsum. No hindlimbs. Distinct external gills. See Conant and Collins (1991; plate 37, pp. 247).

SIMILAR SPECIES: Amphiumas are extremely similar in appearance. However amphiumas lack external gills and have hindlimbs present.

HABITATS FOUND: Primarily in the Cypress/tupelo swamp and the marsh.

ABUNDANCE AND HABITS: A moderately abundant salamander, collected almost exclusively with minnow traps. These salamanders can be extremely abundant in other areas. Chiefly nocturnal. Aquatic as larvae and adults, feeding on small insects and other invertebrates.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	LOW
MINNOW TRAPS	HIGH
TURTLE TRAPS	----
COVERBOARDS	----
ROAD	----

COMMENTS: First documented in the Preserve during our surveys.

Southern Cricket Frog (*Acris gryllus*)

DESCRIPTION: a small frog (ca. 0.5-1 in.) with a triangle on the top of the head between the eyes. Color extremely variable: base color is brown or green, with black, brown, yellow, green, or red markings. Skin with small warts. Small toe pads and distinct webbing between the toes. See Conant and Collins (1991; plate 46, pp. 317).

SIMILAR SPECIES: Most likely to be confused with the greenhouse frog. However, greenhouse frogs are exclusively terrestrial and lack any webbing between the toes. The tip of the snout of greenhouse frogs is usually red.

HABITATS FOUND: Found in all major habitats in the Preserve.

VOICE: a series of clicking sounds varying in speed, often increasing in speed through the call duration.

ABUNDANCE AND HABITS: Active day and night. Terrestrial and aquatic. Conspicuous, often seen year round; less frequently observed in the winter months. Although aquatic, they are often found on land, but are usually relatively close to water. Insectivorous as adults, planktivorous as larvae.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	HIGH
MINNOW TRAPS	----
VOICE	HIGH
COVERBOARDS	LOW
ROAD	LOW

GULF COAST TOAD (*Bufo nebulifer*) (formerly *B. valliceps*)

DESCRIPTION: A moderately large toad (up to 5 inches) with a rough skin and distinct triangular paratoid glands on the dorsal surface near the head. Many specimen with a light stripe down back. Distinct bi-colored (bottom dark, light above) stripes run down the sides; row of tubercles in the same area. Dorsum occasionally flecked randomly with several bright, yellow spots. The cranial crests are well-developed. Males with yellow throats. See Conant and Collins (1991; plate 44, pp. 312).

SIMILAR SPECIES: The only toad found in the Preserve, this species cannot be confused with other frogs.

HABITATS FOUND: Found in all major habitats in the Preserve

VOICE: a shrill trill, often quite loud. Calls commonly after heavy rains.

ABUNDANCE AND HABITS: A moderately abundant toad, usually seen either under coverboards during the day or moving on land at night. Along the Gulf coast, this animal is most abundant in wet, hardwood forests, but appears to inhabit any suitable habitat, and can be found throughout the City of New Orleans. Breeds in a variety of habitats: road side ditches, bayous, canals, and marsh. In the marsh, this species may even breed in brackish water (Dundee and Rossman, 1989).

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	HIGH
MINNOW TRAPS	----
VOICE	HIGH
COVERBOARDS	MODERATE
ROAD	MODERATE

COMMENTS: These toads can be found in high densities during the winter under logs, railroad ties, and other suitable surface cover; this would be an effective monitoring method for this species.

Greenhouse Frog (*Eleutherodactylus planirostris*)

DESCRIPTION: A very small frog (1.25 inches) found only on land. Long toes with a adhesive toepad, but no webbing between the toes. Ground color is dark with a pattern of dark spots or stripes. The snout is usually red. See Conant and Collins (1991; plate 45, pp. 304).

SIMILAR SPECIES: Most likely to be confused with the cricket frog, which is often in or near water, lacks the red snout, and has webbing between the toes.

HABITATS FOUND: Found only in the hardwood forest.

VOICE: Insect-like, described as a series of faint chirps or whistles.

ABUNDANCE AND HABITS: Found only once during the course of our surveys. This is an introduced species from the West Indies. There are no tadpoles in this species. This species has “direct development”, where the eggs hatch out as small froglets.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	LOW
MINNOW TRAPS (larvae)	-----
VOICE	-----
COVERBOARDS	-----
ROAD	-----

COMMENTS: A single specimen was located just outside the Preserve, however, because of its invasive nature, it is (or will) almost certainly be located within the Preserve.

Narrow-mouthed Frog (*Gastrophryne carolinensis*)

DESCRIPTION: A small (ca. 1 in.) frog with a stout body and a small pointed head. Skin has small warts. No toe pads. Ground color variable, from tan to any shade of brown to orange to grey. There is always black flecking on the dorsum, sometimes in the form of two lines down the sides of the back. See Conant and Collins (1991; plate 45, pp. 332).

SIMILAR SPECIES: No other species in the Preserve closely resembles this frog.

HABITATS FOUND: Found in all major habitats in the Preserve

VOICE: The call is a 2-3 second whine, sounding much like a sheep's "whaaaaa."

ABUNDANCE AND HABITS: Nocturnal. Fossorial and terrestrial. A common species in most areas, the narrow-mouthed frog is often found under logs or any other debris harboring moist areas. Males call after rains, often even during the daylight hours. Calls while floating in the water. Very difficult to catch while calling. Insectivorous as adults, planktivorous as larvae.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	MODERATE
MINNOW TRAPS (larvae)	----
VOICE	HIGH
COVERBOARDS	HIGH
ROAD	----

Bird-Voiced Treefrog (*Hyla avivoca*)

DESCRIPTION: A medium-sized , relatively robust tree frog (2 inches) with distinct toepads and a white patch under each eye. The ground color is highly variable, ranging from green to gray to brown. Usually a green wash behind the legs. See Conant and Collins (1991; plate 47, pp. 323).

SIMILAR SPECIES: The only robust treefrog at the Preserve, this species cannot be confused with the other treefrogs, which are much smaller, more slender, and lack the distinct patch under the eye.

One of two similar species of treefrogs (Gray and Cope's Gray Treefrog *Hyla chrysoscelis* and *H. versicolor*) may inhabit the Preserve, but were not documented during the course of our studies. Gray and Cope's gray treefrogs (while indistinguishable from each other) can be discerned from the bird voiced tree frog by their voice and by checking the inside of the hind legs: Gray treefrogs have yellow or orange inner thighs, while bird voiced treefrogs have greenish inner thighs.

HABITATS FOUND: Found in the Hardwood Forest and the Cypress/Tupelo Swamp

VOICE: A beautiful series of distinct, rapidly repeated whistles, sometimes described as "otherwordly" .

ABUNDANCE AND HABITS: Commonly heard calling but only captured twice. Calls nearly all hours of the day, particularly if cloudy. With a little patience, one can locate calling males, which will generally be found calling 6' or more above the ground. Certainly more abundant than our capture data suggest; frequently heard calling in large choruses, which are difficult to quantify in terms of numbers of frogs.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	LOW
MINNOW TRAPS (larvae)	----
VOICE	HIGH
COVERBOARDS	----
ROAD	----

COMMENTS: Any "camouflage" colored treefrog observed should be investigated for potential identification of a Gray or Cope's Gray treefrog (see similar species above).

Green Treefrog (*Hyla cinerea*)

DESCRIPTION: A relatively small (ca. 1.5-2.5 in.) frog that is best identified by the light (white or yellow) line running dorsolaterally from just behind the eye to mid-body. Toe pads present. Color somewhat variable, usually bright green, sometimes brown or even purplish. Color can change with body temperature, warm individuals are generally yellowish, whereas cooler individuals are darker, usually slate gray. Usually no markings on back, except sometimes sprinkled with small yellow spots. See Conant and Collins (1991; plate 47, pp. 319).

SIMILAR SPECIES: The squirrel treefrog often has the same general color pattern, but is smaller and lacks the light line from the eye down the side. The bird voiced treefrog is stockier, with larger toepads and a distinct white spot underneath the eye.

HABITATS FOUND: Found in all major habitats in the Preserve.

VOICE: The breeding call is a repeated "bonk," often likened to the sound of a cowbell. The note is repeated at regular intervals for up to several minutes. Easily confused with the call of the squirrel tree frog.

ABUNDANCE AND HABITS: An extremely abundant frog, one of the most common in the Preserve. Nocturnal, arboreal. The green treefrog is often heard in moderate choruses after heavy rain at night. Males often call from perches on tall weeds near water, where they can also be found by day, often perfectly matching the greenery of their perch. Insectivorous as adults, planktivorous as larvae.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	HIGH
MINNOW TRAPS (larvae)	-----
VOICE	HIGH
COVERBOARDS	LOW
ROAD	HIGH

Squirrel Treefrog (*Hyla squirella*)

DESCRIPTION: Difficult to characterize. A relatively small (ca. 1-1.5 in.) frog that is best identified by elimination of other species (see above). Toe pads present. Color variable, with two common morphs, a medium or light brown with numerous dark brown spots on the back and solid green or brown. To make matters worse, color change is common. See Conant and Collins (1991; plate 47, pp. 321).

SIMILAR SPECIES: The green treefrog is similar in appearance, but has a light (white or yellow) line running dorsolaterally from below the eye to at least mid-body. The bird voiced treefrog is stockier, with larger toepads and a distinct white spot underneath the eye.

HABITATS FOUND: Found mainly in the cypress/tupelo swamp and the hardwood forest; restricted in the marsh.

VOICE: Two distinct calls. The first is often called a "rain call," which resembles the bark of a squirrel. It is a single, scratchy note repeated 4-8 times at a regular interval. The second call or breeding call resembles the nasal "quack" of a duck; it is also a single note repeated at regular intervals, but is more persistent than the rain call, lasting up to several minutes.

ABUNDANCE AND HABITS: Nocturnal and arboreal. A common species, the squirrel treefrog is the frog most often found around buildings, where they capture insects under lights. During the day they hide under bark, logs, or crevices around buildings. Insectivorous as adults, planktivorous as larvae.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	MODERATE
MINNOW TRAPS (larvae)	-----
VOICE	MODERATE
COVERBOARDS	LOW
ROAD	-----

Spring Peeper (*Pseudacris crucifer*)

DESCRIPTION: A rather small treefrog (1.3 inches), usually with a distinct X mark on the dorsal surface. Ground color usually brown to light tan. Usually a dark line between the eyes. See Conant and Collins (1991; plate 46, pp. 325).

SIMILAR SPECIES: Most likely to be confused with the squirrel treefrog, which lacks both the X mark on the back and the line between the eyes.

HABITATS FOUND: Found mainly in the Cypress/Tupelo swamp and the Hardwood Forest.

VOICE: A single, clear note or whistle repeated at a regular interval. One of the most familiar calls in North America. Can often call in large numbers.

ABUNDANCE AND HABITS: Commonly heard calling but captured by hand only once.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	LOW
MINNOW TRAPS (larvae)	----
VOICE	HIGH
COVERBOARDS	----
ROAD	----

COMMENTS: A useful survey technique is to quietly enter ponds during the breeding season and imitate the whistle of the calling male; nearby males will generally respond.

Bronze or Green Frog (*Rana clamitans*)

DESCRIPTION: A medium-sized (ca. 3-3.5 in.) frog with dorsolateral ridges on each side of back. Coloration is variable; sometimes plain brown or green, other animals can be heavily mottled. Skin is smooth, no toe pads, but extensive webbing between the toes. See Conant and Collins (1991; plate 48, pp. 339).

SIMILAR SPECIES: Leopard frogs also have the dorsolateral ridges along sides of back, but have distinct round spots on the back. The pig frog attains a larger size, but smaller individuals might be confused with bronze frogs. However, pig frogs have no dorsolateral ridges along the back.

HABITATS FOUND: Found in all major habitats of the Preserve.

VOICE: A single “clung” or a series of three “clungs” repeated in quick succession (Dundee and Rossman, 1989).

GENERAL HABITS: This was the most abundant frog in our surveys, captured using every method except turtle traps. Easily observed from the boardwalks and commonly heard calling. This frog is commonly preyed upon by garter and water snakes.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	HIGH
MINNOW TRAPS	MODERATE
VOICE	HIGH
COVERBOARD	HIGH
ROAD	MODERATE

Pig Frog (*Rana grylio*)

DESCRIPTION: A large (ca. 3-8 in.) frog with no dorsolateral ridges and a mottled venter. Variable in color, but usually mottled with brown and green on dorsum, with green around the mouth and head. Male frogs have a yellow throat. No toe pads, webbed feet. Skin is smooth. Largest frog at the Preserve. See Conant and Collins (1991; plate 48, pp. 337).

SIMILAR SPECIES : The bullfrog is most similar, aside from the voice, they can only be distinguished in the hand. Check the hind feet; the fourth (and longest) toe is webbed nearly to the tip, whereas in the bullfrog the webbing fails to reach the tip (although this character is subject to wide variation). Another clue is the dorsal coloration; many pig frogs at JELA have two indistinct brown or light green stripes, while the bullfrog will (presumably) lack these. The southern leopard frog is smaller, has distinct large spots on the dorsum, and dorsolateral ridges along sides of back. The bronze frog is smaller and has dorsolateral ridges along the sides of the back.

HABITATS FOUND: Found only in the Marsh.

VOICE: The call is a series of 1-7 (most often 3) deep grunts that are often likened to those of a pig, hence the name.

ABUNDANCE AND HABITS: A moderately abundant frogs, most effectively counted by listening for calls, but adults are readily captured in minnow traps Active by day, but mostly nocturnal. Strictly aquatic, but juveniles can sometimes be found on banks at the waters' edge. Pig frogs replace bullfrogs near coastal areas, and are common in brackish water. Pig frogs are voracious feeders, taking anything that it can swallow. Planktivorous as larvae.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	MODERATE
MINNOW TRAPS	HIGH
VOICE	HIGH
COVERBOARDS	-----
ROAD	-----

Southern Leopard Frog (*Rana utricularia*)

DESCRIPTION: A medium-sized (ca. 3-4 in.) frog with dorsolateral ridges on each side of back. Variable in color, but usually large spots on dorsum which give it its name. Spots and ground color can be any shade of brown or green. No toe pads. Skin is smooth, no toe pads. See Conant and Collins (1991; plate 48, pp. 343).

SIMILAR SPECIES: The pig frog (*Rana grylio*) attains a larger size, but smaller individuals might be confused with leopard frogs. However, pig frogs have no dorsolateral ridges along sides of back and lack spots on the dorsum. Bronze frogs are about the same size as leopard frogs, but lack distinct spots.

HABITATS FOUND: Found in the Cypress/Tupelo Swamp and the Marsh.

LARVAE: Tadpoles with eyes that do not bulge beyond the outline of the head when viewed from above.

VOICE: The call is difficult to characterize, and varies between two basic sounds. The first resembles the sound made when rubbing a balloon with one's hands (snorelike). The second sound, which often follows the first, can be likened to a choppy "baah" or even a laugh. No other frog at the Preserve has a call similar to the leopard frog, easing identification.

GENERAL HABITS: A common species, the leopard frog is the leaper of the frogs of the Preserve, often covering 2 m in one leap. Metamorphs can be extremely common in successful years. Active day and night. Both aquatic and terrestrial. Commonly found in grass near water, where it feeds on insects. When breeding the males float in water and call to females. Males most often call after rains, often even during the daylight hours. Insectivorous as adults, planktivorous as larvae.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	HIGH
MINNOW TRAPS	LOW
VOICE	HIGH
COVERBOARD	----
ROAD	LOW

American Alligator (*Alligator mississippiensis*)

DESCRIPTION: A large crocodilian (up to 14 ft. total length) with a broad snout. Hatchlings are brightly marked with yellow bands. See Conant and Collins (1991; plate 1, pp. 39-40).

SIMILAR SPECIES AT GINS: No species at the Preserve resembles the American alligator.

HABITATS FOUND: Found in the Cypress/Tupelo swamp and the Marsh

ABUNDANCE AND HABITS: Commonly seen basking. Captured mainly in turtle traps. Generally not aggressive, although individuals that become accustomed to humans may become belligerent. Females near nest sites can be highly aggressive. Feeds on fish, turtles, snakes, and invertebrates. Lays eggs.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	HIGH
MINNOW TRAPS	----
COVERBOARDS	----
ROAD	LOW
TURTLE TRAPS	HIGH

Spiny Softshell turtle (*Apalone spinifera*)

DESCRIPTION: a large freshwater turtle (up to 1.5 ft. carapace length) with a soft, leather-like shell and a pointed snout. Ground color a tan or ruddy brown. Males and juveniles with spots. See Conant and Collins (1991; plate 10, pp. 80).

SIMILAR SPECIES: No other turtle found on the Preserve resembles this species

HABITATS FOUND: An extremely restricted distribution within the park. All animals observed in North Twin Canal, but possibly throughout the canal system and natural bayous of the Preserve.

ABUNDANCE AND HABITS: Very rare, seen only three times during our survey. Highly aquatic, but sometimes crosses land during the nesting season. Softshells forage on the bottom of almost any body of water for invertebrates, vertebrates, and carrion.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	MODERATE
MINNOW TRAPS	----
COVERBOARDS	----
ROAD	----
TURTLE TRAPS	----

COMMENTS: This species is also frequently the target for commercial collecting in Louisiana. It is unknown if this may have impacted the populations in the Preserve. Future surveys should target this animal, in order to accurately assess its distribution within the park.

Common snapping turtle (*Chelydra serpentina*)

DESCRIPTION: a large freshwater turtle (up to 1.5 ft. carapace length, up to 35 lb.). Large head, small plastron, long tail saw-toothed on top. Carapace of adults more or less smooth on top, serrated at the rear. Color a dull brown. See Conant and Collins (1991; plate 9, pp. 41).

SIMILAR SPECIES: The alligator snapping turtle closely resembles this species, but has a rough shell and has the three ridges on the carapace. Additionally, when viewed from above, the eyes of the alligator snapping turtle face laterally, whereas the eyes of a common snapping turtle face upward. Young snapping turtles may resemble mud/musk turtles, however these animals have a smooth edge to the back portion of their shell, whereas the posterior portion of the carapace of the snapper is serrated.

HABITATS FOUND: Found only in the Cypress/Tupelo swamp.

ABUNDANCE AND HABITS: Very rare, seen only one time during our survey. Often highly aggressive, will lunge and bite humans who harass them. Aquatic, but frequently crosses land, especially during the nesting season. Snappers forage on the bottom of almost any body of water for invertebrates, vertebrates, and carrion.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	----
MINNOW TRAPS	----
COVERBOARDS	----
ROAD	LOW
TURTLE TRAPS	----

COMMENTS: This species is frequently the target for commercial collecting in Louisiana. It is unknown if this may have impacted the populations in the Preserve.

Southern Painted Turtle (*Chrysemys picta*)

DESCRIPTION: a rather small freshwater turtle (typically 4-5 inches) with a dark upper shell and a bright red, orange or yellow stripe down the middle of the upper shell (stripe will become slightly obscure in dry specimens). Lower shell yellow, with bright markings along the bridge between the top and lower shell. See Conant and Collins (1991; plate 7, pp. 71).

SIMILAR SPECIES: The cooter and the red-eared slider are both roughly similar, but both are much larger and lack the distinctive red-stripe on the upper shell.

HABITATS FOUND: Found only in the Cypress/Tupelo swamp.

ABUNDANCE AND HABITS: Commonly seen basking. Seems restricted in distribution, seen mainly in only a few areas on the Preserve. A relatively uncommon (even rare) turtle throughout Louisiana, this population is the largest population of southern painted turtles the authors have observed. Because of its relative rarity in other parts of its range, its restricted distribution within the Preserve, and its popularity in the pet trade, this species should be of high conservation concern at Jean Lafitte National Historical Park and Preserve.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND(Visual)	HIGH
MINNOW TRAPS	----
COVERBOARDS	----
ROAD	----
TURTLE TRAPS	LOW

COMMENTS: If appropriate capture methods could be worked out, this would make an interesting study species, as the Preserve is near the southern extent of this species' range. Relative effectiveness of turtle traps are subject to bias, as many of the areas where painted turtles are found are along public access trails, prohibiting the placement of turtle traps.

Mud Turtle (*Kinosternon subrubrum*)

DESCRIPTION: a small freshwater turtle (up to 5 in. carapace length). Brownish in color, often with yellow and brown on the plastron. Broken, yellow stripes on head common to animals from Barataria. Two hinges on the plastron. Barbels on chin. Short tail. See Conant and Collins (1991; plate 2, pp. 48).

SIMILAR SPECIES: The stinkpot (*Sternotherus odoratus*) closely resembles this species. However, the stinkpot lacks the second plastron hinge (and the one it does have is rudimentary). Additionally, the stinkpot typically has exposed skin between the plastron elements, whereas mud turtles never have skin between the plastron elements. Young of common and alligator snapping turtles superficially resemble this species, but lack any yellow markings on head and have rough carapaces (particularly on the posterior edges) , whereas the mud turtle has a smooth carapace.

HABITATS FOUND: Found in both the Hardwood Forest and the Cypress/Tupelo swamp.

ABUNDANCE AND HABITS: Moderately common and can be spotted basking on logs in appropriate aquatic areas in the spring. Inhabits not only permanent water, but also ephemeral woodland ponds. Nocturnal. Some are aggressive but most are not. Aquatic, but often found in terrestrial situations, especially in swampy or wet areas. These turtles feed primarily on aquatic snails, other mollusks and invertebrates.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	HIGH
MINNOW TRAPS	----
COVERBOARDS	----
ROAD	LOW
TURTLE TRAPS	----

Alligator Snapping turtle (*Macrolemys temminckii*)

DESCRIPTION: a very large freshwater turtle (up to 2.5 ft. carapace length, up to 125 lb.). Large head with strongly hooked upper jaw, small plastron, and a long tail. Three horny ridges run full length of carapace. Characteristic “eyebrows” surrounding eyes. Color a dull brown. See Conant and Collins (1991; plate 3 & 10, pp. 42).

SIMILAR SPECIES: The common snapping turtle closely resembles this species, but has a smooth(er) shell and lacks the three ridges on the carapace. Additionally, when viewed from above, the eyes of the alligator snapping turtle face laterally, whereas the eyes of a common snapping turtle face upward.

HABITATS FOUND: Found only in the Cypress/Tupelo swamp, particularly in the natural bayou system (Bayou des Familles, Bayou Coquille). It is unknown if this turtle lives in the larger channel systems which are found throughout the marsh.

ABUNDANCE AND HABITS: Very rare, seen only two times during our survey, but could be more abundant than believed, as this species is very secretive. Often highly aggressive, will lunge and bite humans who harass them. Aquatic except for females during the nesting season. Alligator snappers forage on the bottom of almost any body of water for invertebrates, vertebrates, and carrion.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	LOW
MINNOW TRAPS	-----
COVERBOARDS	-----
ROAD	-----
TURTLE TRAPS	LOW

COMMENTS: This species is frequently the target for commercial collecting in Louisiana. We have commonly observed “trot-lines” being used by fishermen in the park, which is one of the primary capture methods for this animal. Indeed, a law enforcement officer approached one of us (N.J.A.) and reported finding 21 “jug-lines” set in Bayou des Familles, several of which had alligator snapping turtles hooked on the line. The potential impact of this activity on the alligator snapping turtle populations in the Preserve could be severe, and warrants further study (as well as prohibition of this activity).

River Cooter (*Pseudemys concinna*)

DESCRIPTION: a large freshwater turtle (up to 1.5 ft. carapace length). Belly plain yellow or cream. Hollow circles on underside of marginal scutes. Color greenish or brownish and heavily marked. Head heavily striped. See Conant and Collins (1991; plate 8, pp. 68. Note the plate in Conant and Collins of this animal is of a juvenile; adults are much less vividly marked).

SIMILAR SPECIES: The red-eared slider (*Trachemys scripta*) has vertical stripes on the rear soft parts, large black smudges on each plastral scute and most individuals will have a red stripe on the head.

HABITATS FOUND: Found in the Cypress/Tupelo Swamp, in larger water bodies (Bayou des Familles and Twin Canals).

ABUNDANCE AND HABITS: A locally common turtle at the Preserve, it was commonly seen basking but never captured in our traps. These turtles are very difficult to trap, as they are herbivorous and are not attracted to the bait we used. Aquatic; seldom seen away from water except for females during the nesting season. The cooter is an inhabitant of large bodies of water such as marshes, rivers, and extensive swamps.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND (visual)	HIGH
MINNOW TRAPS	----
COVERBOARDS	----
ROAD	----
TURTLE TRAPS	----

COMMENTS: While we captured many of these turtles during the course of our studies at the Preserve, the majority of the captures and sightings were at North Twin Canal.

Stinkpot or Common Musk Turtle (*Sternotherus odoratus*)

DESCRIPTION: a small freshwater turtle (up to 5 in. carapace length). Brownish in color, often with yellow and brown on the plastron. One rudimentary hinge on the anterior portion of plastron (commonly not observable, but flexes when pressed). Plastron narrow. Males tend to have large areas of skin between plastral elements. Barbels on chin. Short tail. See Conant and Collins (1991; plate 2 & 3, pp. 44).

SIMILAR SPECIES: The common mud turtle closely resembles this species, but has two hinges on the plastron, which the stinkpot lacks. Commonly, the stinkpot will have areas of skin on the plastron between scutes, whereas the common mud turtle lacks areas of skin. Young of common and alligator snapping turtles superficially resemble this species, but lack any yellow markings on head and have rough carapaces (particularly on the posterior edges) , whereas the stinkpot has a smooth carapace.

HABITATS FOUND: Found in both the Marsh and the Cypress/Tupelo swamp.

ABUNDANCE AND HABITS: Moderately common, especially by hand. Some are aggressive but most are not. Aquatic, but often found in terrestrial situations, especially in swampy or wet areas. These turtle feed primarily on invertebrates.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	LOW
MINNOW TRAPS	----
COVERBOARDS	----
ROAD	----
TURTLE TRAPS	----

COMMENTS: Despite intense trapping and nocturnal surveys for this animal, only two representatives of this species were captured during the course of our studies. One was a shell found at the end of Wood Duck trail, and another was found in the stomach of a dead alligator from the Marsh.

Box Turtle (*Terrapene carolina*)

DESCRIPTION: a medium-sized terrestrial turtle (up to 6 in. carapace length). The plastron has two hinges and can close completely. Carapace generally brownish or black ground color, often covered with yellow streaks. Head and limbs sometimes marked with yellow or orange spots (or both). This species is sexually dimorphic; males have orange or red eyes, while females have brown eyes. See Conant and Collins (1991; plate 3 & 5, pp. 52).

SIMILAR SPECIES: No turtle species found at the Preserve closely resembles the box turtle.

HABITATS FOUND: Found only in the Hardwood Forest.

ABUNDANCE AND HABITS: Moderately common, captured mainly by hand during visual encounter surveys. Very docile, will not bite. Terrestrial and fossorial. The box turtle lives in a variety of habitats, where it eats earthworms, insects, berries, and vegetation. Box turtles are often active after rains.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	HIGH
MINNOW TRAPS	----
COVERBOARDS	----
ROAD	LOW
TURTLE TRAPS	----

COMMENTS: Due to heavy collecting for the pet trade, box turtles were recently listed under CITES, an international treaty governing exports of endangered species. International exports of box turtles have now been officially banned under this treaty.

Red-eared slider (*Trachemys scripta*)

DESCRIPTION: a moderate to large freshwater turtle (up to 1 ft. carapace length). Usually a bright red stripe behind the eye, but this can be lost in old adults. Striped "pants" on rear of hind legs is distinctive. Color greenish or brownish and heavily marked. Adult males often blacken with age. See Conant and Collins (1991; plate 4 & 7, pp. 65).

SIMILAR SPECIES: The cooter (*Pseudemys concinna*) lacks vertical stripes on the backs of the rear legs and also lacks any form of a red-stripe on the head. Juveniles of these species are similar, but young sliders have a bright red stripe on side of head.

HABITATS FOUND: Found in the Cypress/Tupelo Swamp and Marsh.

ABUNDANCE AND HABITS: This is probably the most abundant turtle at the Preserve. Some are aggressive but most are not. Aquatic, but often found crossing land, especially females during the nesting season. The red-eared slider is the most common aquatic turtle in the southern US, and can be found in every freshwater aquatic situation. Feeds on invertebrates and vegetation.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	HIGH
MINNOW TRAPS	----
COVERBOARDS	----
ROAD	LOW
TURTLE TRAPS	HIGH

COMMENTS: Still widely harvested for the pet trade in Louisiana, and impacts on populations can be significant. There is no information as to whether the population at the Preserve has been impacted by collectors.

Green Anole (*Anolis carolinensis*)

DESCRIPTION: a medium-sized lizard (up to 6 in. total length), with a light line down the back; color is usually solid green or solid brown. Many specimens at JELA will have also have a white stripe on back; this has been documented on both males and females at this site. Males with a large head and a red/pink throat fan. Some males will have a dark stripe behind eye and a low, fleshy crest on neck and first part of body. Belly plain white. See Conant and Collins (1991; plate 13, pp. 90).

SIMILAR SPECIES: No lizards found at JELA closely resemble green anoles. The brown anole (*A. sagrei*) is very similar, but was not found on the Preserve during our study (see below).

HABITATS FOUND: Found throughout the Preserve.

ABUNDANCE AND HABITS: Disposition: some are aggressive, but most docile. Diurnal. Chiefly arboreal, occasionally terrestrial. Green anoles are commonly found on vegetation and trees where they capture insects using keen eyesight and a relatively long tongue. They have the ability to match backgrounds well, and can change from green to brown (or vice versa) in less than 1 minute. Males advertise for females and mark territories by bobbing their heads and spreading their throat fans.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	HIGH
ROAD	-----
COVERBOARDS	MODERATE

COMMENTS: One of the most common and conspicuous lizards at Jean Lafitte National Historical Park and Preserve. Can be found active during the daylight and found sleeping at night by shining a flashlight into the overhead branches (typically less than 15ft) and looking for the bright, white belly. The brown anole (*Anolis sagrei*) is an exotic species that has become established in the greater New Orleans area. Following introductions of brown anoles, the green anole populations generally tend to decline. While not found at the Preserve during the course of our studies, the brown anole is likely to become introduced, and so regular surveys of the green anole would be of benefit. The brown anole is brown (and never green) and males of this species have an orange-red dewlap, or throat fan. Males of green anoles have pink dewlaps.

Five-lined skink (*Eumeces fasciatus*)

DESCRIPTION: a large stout skink (5-8.5 inches in total length). Sexes differ in appearance: adult males may have faint stripes on a gray, brown, or gold dorsum, and reddish highlights on the sides of the head. Females have five yellow, longitudinal stripes on a chocolate brown background. Adult females and juveniles typically have a bright blue tail. Juveniles resemble adult females, but are more brilliantly colored. Belly white or cream. See Conant and Collins (1991; plate 19, pp. 128).

SIMILAR SPECIES: Most individuals of the broadhead skink are nearly identical to five lined skinks (differing only on a few scalation characteristics-see pp. 129 in Conant and Collins 1991 for a drawing). Male broad heads resemble male five lined skinks, with two exceptions: Broadheads are significantly larger (nearly a foot in total length) and have *massive orange heads*. Ground skinks are superficially similar, but are much smaller, lack the yellow stripes down the back and lack the blue tail.

HABITATS FOUND: Found in both the Hardwood and the Cypress tupelo habitats. Appear to have a limited distribution in the forested regions on the dikes near marsh habitats.

ABUNDANCE AND HABITS: Disposition: aggressive, often bites, but too small to do any real harm. Arboreal and terrestrial, can be seen by day crawling up and down the trunks of trees. Like all other lizards, the tail breaks easily. A readily observable lizard, which can be found while walking various boardwalks of the park. A nest of eggs was found inside a hollow of a tree near the education center. The eggs are pliable, and ovoid.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	HIGH
ROAD	----
COVERBOARDS	HIGH

Mediterranean gecko (*Hemidactylus turcicus*)

DESCRIPTION: A small lizard (4-5 inches in total length). Pale tan, skin covered with horny tubercles, possibly with faint markings. Dark eyes apparent. Enlarged toe pads on feet, each equipped with claws. See Conant and Collins (1991; plate 11, pp. 85).

SIMILAR SPECIES: Few species of lizards are likely to be confused with the Mediterranean gecko.

HABITATS FOUND: Man made buildings within the Hardwood forest.

ABUNDANCE AND HABITS: INTRODUCED. Completely nocturnal, although the occasional individual may be found by daylight hours in its resting quarters. Nearly always found on some man-made structure, chiefly buildings. Our only nocturnal lizard at JELA, it forages on the sides of buildings, eating insects that are attracted to the light. Their native range includes the rocky coastline of the Mediterranean, and so where introduced, these animals generally avoid excursions into the forested regions surrounding a building.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	HIGH
ROAD	----
COVERBOARDS	----

COMMENTS: This study was the first documentation of this species in the Preserve. Only two Mediterranean geckos were documented during the course of our surveys; however, we feel that the establishment of permanent populations at the park is nearly inevitable, as they hitch-hike on vehicles. Interestingly, one possible source is the State Park to the Northwest of the park; one of us (NJA, pers. obs.) would routinely observe more than 50 lizards on the sides of one of the bathroom facilities. Measures to retard the establishment of this species in the park would involve sealing of cracks and prevent the warping of boards on park buildings, in order to limit their ability to find daylight refuge.

Ground Skink (*Scincella laterale*)

DESCRIPTION: a small slender skink (up to 4 in. total length) with tiny legs. Usually a shiny brown or reddish-brown dorsum, with two dark stripes down the sides of the body. Tail is sometimes orange-brown. Some individuals may be completely black. See Conant and Collins (1991; plate 19, pp. 128).

SIMILAR SPECIES: Few lizard species at JELA closely resemble the ground skink, but the dwarf salamander (*Eurycea quadridigitata*) superficially resembles the ground skink when viewed at a distance. The dwarf salamander has wet skin and lacks the claws and scales of the ground skink.

HABITATS FOUND: Found in all habitats of the preserve, as long there are dry areas to reside upon.

ABUNDANCE AND HABITS: Disposition: docile, does not bite. Terrestrial. These skinks do much of their foraging in and under the leaf litter, where they feed on small arthropods. They often have regrown tails, which replace the original tails they lose to would-be predators. Lays eggs (typically in clutches of 2-3).

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	HIGH
ROAD	----
COVERBOARDS	HIGH

COMMENTS: The most abundant of any animal observed during the course of our studies; this species could be a useful ecological indicator.

Southern Copperhead (*Agkistrodon contortrix*)

DESCRIPTION: a medium-sized snake (generally 2- 3 ft. in total length) with a distinct “hourglass” pattern across its back. At JELA, individuals with broken hourglass patterns are relatively common. Background color is generally a light tan or gray, while the “hourglasses” are generally chestnut brown. Juveniles are more vividly marked (similar to adults) with reddish-brown and have bright green tails. Vertical pupils. Heat-sensitive pit between the eyes and nostrils. See Conant and Collins (1991; plate 34, pp. 227).

SIMILAR SPECIES: The Copperhead is one of the most distinct patterned snakes at JELA, and so are unlikely to be confused with many other snakes. However, juvenile cottonmouths do resemble copperheads, but have a more reddish background coloration, and a dark stripe running through the eye which is bordered above and below by two white stripes.

HABITATS FOUND: Copperheads are most common in the hardwood forests of the Preserve, but occasionally, individuals may be found on higher ground in cypress swamps.

ABUNDANCE AND HABITS: Disposition: venomous, but often docile until molested. Will “rattle” tail when cornered. Typically nocturnal. Primarily terrestrial and commonly found under logs. Gives birth to live young.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	HIGH
ROAD	MODERATE
COVERBOARDS	HIGH

COMMENTS: While not often observed by visitors to the park, the copperhead can be locally abundant, and it was common to find nearly a six or more individuals in a short period of time in the appropriate habitat.

Cottonmouth (*Agkistrodon piscivorus*)

DESCRIPTION: a medium-sized snake (at JELA individuals are typically 15” to 2 ft., other areas these snakes can reach up to 4 ft. in total length) with an indistinct pattern. Color usually various shades of brown and black, but some specimens appear nearly black. Juveniles are more vividly marked with reddish-brown and have a bright green tail. Vertical pupils. Heat-sensitive pit between the eyes and nostrils. See Conant and Collins (1991; plate 34, pp. 228-9).

SIMILAR SPECIES: Most water snakes superficially resemble the cottonmouth, especially the yellow-bellied water snake (*Nerodia erythrogaster*) and the banded water snake (*N. fasciata*). However, water snakes lack pits, have round pupils, and are more likely to flee when approached. Nevertheless, no aquatic snake should be handled unless the worker has been thoroughly trained in the identification of venomous snakes.

HABITATS FOUND: Found throughout the Preserve.

ABUNDANCE AND HABITS: Disposition: venomous, but often docile until molested. Some individuals will “rattle” tail upon capture. Diurnal and nocturnal. Terrestrial and aquatic. Cottonmouths are common snakes in moist areas where they feed on frogs, fish, mice, rats, and other snakes. They are named for their habit of showing the inside of their mouth when threatened, which is a cottony white color. Gives birth to live young.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	HIGH
ROAD	-----
MINNOW TRAPS	-----
COVERBOARDS	-----

COMMENTS: Cottonmouths were found in nearly every microhabitat, and were never very far from water. By daylight, this snake can be found basking along the Visitor Center trail and the Bayou Coquille trail. At dusk, these animals become active and begin foraging for their prey.

Black-masked Racer (*Coluber constrictor*)

DESCRIPTION: a relatively large (up to 6 ft. in total length), slender snake with a slate-gray topside and a white/cream patterned underside. Head offset from the body, with a distinct black mask along side the head. Juveniles, which do not resemble adults in color pattern, are marked with imperfect brownish-red saddles on a lighter gray or white ground color. See Conant and Collins (1991; plate 26, pp. 185 *note plate in Conant and Collins does not contain an accurate picture of this variant of racer).

SIMILAR SPECIES: No other species of snakes at JELA posses the key diagnostics of the adults of this species. Juvenile racers may be confused with young rat snakes (*Elaphe obsoleta/spilotes* complex), however racers have smooth scales, a pattern that fades towards the tail (and is commonly completely indistinct at the tail) and has a rounded body. Rat snakes have lightly keeled scales, a distinct pattern even on the tail, and a body that is distinctly bread-loaf shaped in cross-section.

HABITATS FOUND: Found in all habitats at Jean Lafitte National Historical Park and Preserve.

ABUDNANCE AND HABITS: Disposition: non-venomous, but highly aggressive, bites almost invariably. Rattles tail in defense. Racers are both terrestrial and arboreal and are active during the day. They can often be seen in very hot weather when most other reptiles are inactive. They eat grasshoppers and insects, as well as mice, frogs, turtles, and lizards. They are known for their burst speed and are so named. Lays eggs.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	HIGH
ROAD	HIGH
MINNOW TRAPS	-----
COVERBOARDS	MODERATE

COMMENTS: This species of snake is frequently observed most commonly as road-kill along Hwy 45 in the Preserve.

Canebrake rattlesnake (*Crotalus horridus*)

DESCRIPTION: a large snake (commonly 4-5 feet in total length). The canebrake rattlesnake has a slate gray ground color, with black bands across back. Commonly, a reddish brown stripe runs down the back from the head to the tail, although this may be indistinct in some individuals. Tail is jet black and ends with a string of rattles. See Conant and Collins (1991; plate 35, pp. 233).

SIMILAR SPECIES: A relatively distinct snake, only the pygmy rattlesnake (*Sistrurus miliarius*) would be similar, but was not found during our surveys of JELA. Canebrake rattlesnakes can be distinguished from the pygmy both in terms of size (pygmies are diminutive, often less than 12" long) and tail coloration (pygmies have a banded tail). Additionally, pygmy rattlesnakes have several large plate-like scales on the head, whereas the head of a canebrake is covered in small scales.

HABITATS FOUND: Found in the Hardwood forest.

ABUNDANCE AND HABITS: Disposition: venomous, however, a very docile snake, generally refraining from rattling until seriously molested. Usually active during the night; occasionally found active in the early morning and late evening. Terrestrial and occasionally arboreal. Prey generally restricted to small mammals of appropriate size: squirrels, mice, rats, and rabbits. Gives birth to live young.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	-----
ROAD	LOW
MINNOW TRAPS	-----
COVERBOARDS	-----

COMMENTS: Apparently, this snake was once more common in this area, and has declined because of human hunting during the early years of the Preserve's establishment. Only a single specimen detected during the course of our studies.

Texas /Grey ratsnake complex (*Elaphe obsoleta*, *E. spilotes*)

DESCRIPTION: a large snake (typically four to six feet in total length). Adults: Can have either jet black, brown, or gray ground color with black, brown or reddish blotches on back (and anywhere in-between!). Heads of adults usually a uniform gray or black color. Belly white with black checkers, some with half moon shapes along edge of ventrals instead of checkers. Juveniles, boldly marked, pattern becoming more diffuse with age. See Conant and Collins (1991; plate 28, pp. 197-9).

SIMILAR SPECIES: Young of this species superficially resemble young black masked racers, however, in rat snakes, the blotched pattern is distinct on the tail, whereas in the racer, the pattern fades on the tail.

HABITATS FOUND: Found throughout the Preserve.

ABUNDANCE AND HABITS: Disposition: non-venomous, but generally aggressive and will bite readily. "Rattles" tail in defense. Usually active during the day; occasionally nocturnal. Generally found on the ground, although highly arboreal (occasional specimens can be found falling from trees). Consumes mammals and birds, juveniles are known to take lizards. A common snake. Lays eggs.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	LOW
ROAD	LOW
MINNOW TRAPS	-----
COVERBOARDS	LOW

COMMENTS: Formerly a single species with several subspecies, this species was recently split into three separate species based on molecular and multivariate morphological analysis by F. Burbrink (Burbrink et al. 2000; Burbrink 2001). Two species are likely to occupy Jean Lafitte National Historical Park and Preserve, however, they are virtually indistinguishable in the hand! One specimen from JELA was verified by F. Burbrink to be a Texas rat snake (*E. obsoleta*).

Mud snake (*Farancia abacura*)

DESCRIPTION: A medium sized snake, adults are typically 4ft in length. Dorsum is a shiny jet black and venter is generally red and yellow with black checkers. *Smooth scales*. Ventral coloration extends onto sides. See Conant and Collins (1991; plate 25, pp. 182).

SIMILAR SPECIES: Relatively few snakes can be confused with the mud snake, although the occasional banded water snake may come close. Check the scales- mud snakes will have smooth and shiny scales even if dry (water snakes will have dull colored, keeled scales).

HABITATS FOUND: Found in the Cypress tupelo swamps (possibly in ponds in hardwood forests); while our study did not find them in the marsh, they presumably occur there.

ABUNDANCE AND HABITS: A rarely seen snake, most specimens are seen during its April/ May mating season, and virtually all of these are males in search of females. A denizen of the swamps and marshes of the deep south, it derives its name from the unconsolidated muck in which it lives. Occasional specimens are found below the surface of the water in the root masses of Cypress trees. Very docile. Upon capture many specimens will poke their sharp (but harmless) tail into their captors hands and spastically as if striking, but it is merely a bluff. Consumes amphibians, primarily sirens and amphiuma. Lays eggs.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	LOW
ROAD	MODERATE
MINNOW TRAPS	-----
COVERBOARDS	-----

COMMENTS: While most of our specimens came from animals found dead on the road during this study, they are most commonly captured in minnow traps at our other study sites.

Speckled Kingsnake (*Lampropeltis getula*)

DESCRIPTION: a large snake (typically three to four feet in total length), the kingsnake has a black ground color, and white, yellow, or green spots throughout. Skin is shiny and smooth. The venter is checkered with black and yellow or white. See Conant and Collins (1991; plate 29, pp. 206).

SIMILAR SPECIES: Few species of snakes are likely to be confused with this animal.

HABITATS FOUND: Presumably found throughout the Preserve, however, we only documented its occurrence in the Hardwood forest.

ABUNDANCE AND HABITS: Disposition: non-venomous, but about half are aggressive and will bite. When cornered, will shake tail vigorously, creating a buzzing sound. Usually active during the day; occasionally nocturnal. Terrestrial and occasionally arboreal. Kingsnakes are so named for their habits of eating other snakes, but they are generalists, and will also take mice, rats, birds, and lizards. Juveniles readily eat skinks. A common snake near developed areas. Lays eggs.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	----
ROAD	LOW
MINNOW TRAPS	----
COVERBOARDS	----

COMMENTS: Apparently once common at JELA, our studies documented only a single individual captured during the last few days of the study, despite intensive surveying. This snake is prized in the pet trade, and it is possible that the apparent lack of kingsnakes at the Preserve is linked to this activity. Common collecting techniques for this animal include: rolling logs, flipping cover, peeling bark from trees, and driving slowly on roads. Pillow cases, potato rakes, hooks, and tongs are common paraphernalia carried by collectors. Any signs of this activity should be reported to law enforcement immediately.

Louisiana milk snake (*Lampropeltis triangulum*)

DESCRIPTION: a small snake (typically 1-1.5ft in total length). A tri-colored snake, with alternating rings of red, black and white (with the black bordering the white bands). Louisiana milk snakes are typically brilliantly colored with shiny skin. Juveniles patterned as adults. See Conant and Collins (1991; plate 30, pp. 210).

SIMILAR SPECIES: Few species of snakes are likely to be confused with this animal. Superficially resemble the venomous coral snake, which is not found in the Preserve.

HABITATS FOUND: Found in the Hardwood forest and Cypress-tupelo swamp.

ABUNDANCE AND HABITS: Disposition: non-venomous and generally a mild-mannered snake. These snakes are generally semi-fossorial, but can be found active on the surface in the early morning and late evening. Feeds primarily on lizards, their eggs and small mammals. Lays eggs.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	LOW
ROAD	-----
MINNOW TRAPS	-----
COVERBOARDS	LOW

COMMENTS: This beautifully patterned snake is also prized in the pet trade, with individuals of this species selling for over \$100 U.S. Collecting techniques for this animal are similar to the speckled kingsnake. One of us (N.J.A., pers. obs.) has spoken with collectors who report collecting Louisiana milk snakes within the boundaries of the Preserve. One individual reported having collected milk snakes from cypress stumps by flushing them out with gasoline.

Mississippi Green Water Snake (*Nerodia cyclopion*)

DESCRIPTION: a large, stout snake, (up to 4 ft.), with a narrow head. Color greenish with black markings; no distinctive pattern. Lower jaw of this animal is generally yellow. Belly dark with white, yellow, or cream-colored half moons. Occasional specimens will be found with an aberrantly colored dark brown/black belly which lacks any light markings. Young patterned similar to adults. See Conant and Collins (1991; plate 21, pp. 147).

SIMILAR SPECIES: Three other snakes are similar to the green water snake: the diamondback water snake, the banded water snake and the cottonmouth. The most similar snake to the green water snake is the diamondback water snake (*Nerodia rhombifer*). The chief distinction is that the diamondback water snake has obscure, but visible patterning, whereas the green water snake generally lacks any pattern and is simply mottled with black. Additionally, the belly of the green water snake is mostly black with yellow half moons, whereas the belly of a diamondback water snake is primarily white. Banded water snakes (*Nerodia fasciata*) have distinct bands along the back, and usually have a dark line between the eye and the angle of the jaw. At JELA, the banded water snake generally has some reddish brown coloration on it (both on the back and the venter), whereas the green water snake lacks any indications of red. However, banded water snakes are extremely variable, and care must be taken to distinguish these two species. Cottonmouths (*Agkistrodon piscivorous*) can be differentiated by having (a) a wide head, (b) a pit between the eye and the nostril, and (c) vertical pupils. All of these characters require a close proximity between the observer and the snake, which can present problems. Perhaps the best clue is behavior; cottonmouths tend to stand their ground and gape their mouths when threatened, whereas water snakes tend to flee. NOTE: cottonmouths are very common at the Preserve; observers should be extremely cautious about handling any "water snake" in these areas until a positive identification has been made.

HABITATS FOUND: This species is primarily found the Marsh, smaller numbers have been observed along the transition zone between the Marsh and the Cypress-tupelo habitats.

ABUNDANCE AND HABITS: Disposition: non-venomous, very aggressive. Diurnal and nocturnal. Strictly aquatic. Usually found in large expanses of water, such as marshes and lakes and continuous swamps. Feeds mainly on fish but one snake was found with a partially digested crawfish in its stomach. Gives birth to live young.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	HIGH
ROAD	----
MINNOW TRAPS	HIGH
COVERBOARDS	----

COMMENTS: The green water snake can be commonly observed by canoeing the waterways of Twin Canals, Kenta Canal and the various Trenasses that cut through the marsh. Look for the snakes to be basking in branches overhanging the water. In the spring, pairs of snakes can be observed courting and mating on branches that emerge from the water.

Yellow-bellied Water Snake (*Nerodia erythrogaster*)

DESCRIPTION: a stout, large (up to 4 ft.) snake, with a broad head. Color a uniform black (sometimes almost blueish) on top and orange-yellow on the venter. Scales above and below lips yellow with black stripes. Scales keeled. Juveniles are patterned; generally they have a whitish/cream background with black spots and become darker as they age. See Conant and Collins (1991; plate 20, pp. 150).

SIMILAR SPECIES: Can be distinguished from all other water snakes by the black ground color and plain yellow belly (all other water snakes have a patterned belly). Cottonmouths (*Agkistrodon piscivorus*) have nasal pits and vertical pupils, as well as a patterned belly. Aside from having this snake in hand, another clue is the habitat (see below), this is the most terrestrial of our water snakes. Note: no attempt should be made to handle any “water snake” unless trained in the identification of these species.

HABITATS FOUND: Primarily found in the hardwood forest.

ABUNDANCE AND HABITS: Disposition: non-venomous but aggressive. Will generally flee once discovered. When cornered, this snake typically flattens its head and body and strikes vigorously. Diurnal and nocturnal. Aquatic and terrestrial. These snakes are the most terrestrial of the water snakes, and will often flee out of water when alarmed. Often found as far as 100 m from water. Feeds mainly on frogs. Gives birth to live young.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	LOW
ROAD	LOW
MINNOW TRAPS	-----
COVERBOARDS	-----

COMMENTS: One of the least frequently encountered snakes at JELA. Only three individuals were found, two near the Education Center and another along the Plantation trail. Minnow traps are effective at other sites.

Banded Water Snake (*Nerodia fasciata*)

DESCRIPTION: a stout, large (up to 4 ft, more typically around 2 ft.) snake, with a broad head. Color and pattern extremely variable, but usually with transverse bands across the back. Bands may have brown, black, red, and white in them. There is usually a distinct line between the eye and the angle of the jaw. Ground color is difficult to resolve, but is usually some shade of those colors. Venter is cream colored and checkered with reddish-brown. Young: more vividly marked, becoming more obscure with age. See Conant and Collins (1991; plate 20, pp. 153).

SIMILAR SPECIES: The banded water snake is easily confused with three other species of water snakes and the cottonmouth. Check the following characteristics: Green water snakes will always have an obscure pattern on their dorsum and generally have a black belly with yellow moon shaped markings. Diamondback water snakes have a brown dorsum with a diffuse chain-like pattern; belly is white with random, black markings. Yellowbelly water snakes are dark above, with a plain yellow belly.

Cottonmouths can be differentiated by having (a) a wide head, (b) a pit between the eye and the nostril, and (c) vertical pupils. All of these characters require a close proximity between the observer and the snake, which can present problems. Perhaps the best clue is behavior; cottonmouths tend to stand their ground and gape their mouths when threatened, whereas water snakes tend to flee. NOTE: cottonmouths are very common; observers should be extremely cautious about handling any “water snake” in these areas until a positive identification has been made.

HABITATS FOUND: Found throughout the Preserve.

ABUNDANCE AND HABITS: Disposition: Non-venomous, aggressive. Diurnal and nocturnal. Mainly aquatic, occasionally terrestrial. These snakes are the most common water snake at JELA, where they are found in many aquatic habitats, ranging from temporary and permanent ponds to ditches to fresh and slightly brackish marshes. Feeds mainly on frogs and small fish. Gives birth to live young.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	HIGH
ROAD	LOW
MINNOW TRAPS	LOW
COVERBOARDS	LOW

COMMENTS: Banded water snakes show an interesting behavior at JELA. When a south wind blows the water out of the marsh and swamp areas, these snakes can be readily observed feeding in the small, isolated pools that form as a result. During these times, banded water snakes can be observed for over an hour, traveling from one pool to the next, dipping their heads in the water and feeding on the mosquitofish and tadpoles that remain.

Diamondback watersnake (*Nerodia rhombifer*)

DESCRIPTION: a large, stout snake, (up to 4 ft.), with a narrow head. Color greenish with black markings; with a chain-link pattern on the back (may be obscured in some individuals). Belly is generally white and/or yellow, with various dark checkers on the venter. Young: similar to adults, but pattern more obvious. See Conant and Collins (1991; plate 21, pp. 149).

SIMILAR SPECIES: The diamondback water snake is easily confused with three other species of water snakes and the cottonmouth.

Check the following characteristics: Green water snakes will always have an obscure pattern on their dorsum and generally have a black belly with yellow moon shaped markings. Banded water snakes can have dark patterns, but this never resembles a chain-like pattern; belly white with red or brown checkers. Yellowbelly water snakes are dark above and lack any pattern, with a plain yellow belly.

Cottonmouths (*Agkistrodon piscivorous*) can be differentiated by having (a) a wide head, (b) a pit between the eye and the nostril, and (c) vertical pupils. All of these characters require a close proximity between the observer and the snake, which can present problems. Perhaps the best clue is behavior; cottonmouths tend to stand their ground and gape their mouths when threatened, whereas water snakes tend to flee. NOTE: cottonmouths are very common at the Preserve; observers should be extremely cautious about handling any "water snake" in these areas, unless trained in identification of these animals.

HABITATS FOUND: This species appears to inhabit the transition zone between the marsh and the cypress swamp habitat.

ABUNDANCE AND HABITS: Disposition: non-venomous, very aggressive. Diurnal and nocturnal. Strictly aquatic. The diamondback water snake is a snake of deep water, which is probably why it is not very common at JELA. Adults dive to the bottom of rivers and bayous at night to forage on fish sleeping on the bottom. Feeds mainly on fish. Gives birth to live young.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	LOW
ROAD	----
MINNOW TRAPS	----
COVERBOARDS	----

COMMENTS: Because of its affinity for deeper water, future surveys should attempt night surveys using powerful spotlights along the shoreline of the Intercoastal waterway on the south end of JELA.

Rough Green Snake (*Opheodrys aestivus*)

DESCRIPTION: a very slender, medium-sized (up to 3 ft.) snake, with a bright green dorsum. Venter is usually yellow or white. Head larger than body, large eyes. Dead animals will appear blue. See Conant and Collins (1991; plate 25, pp. 189).

SIMILAR SPECIES : No snake at JELA resembles the rough green snake.

HABITATS FOUND: One individual was found in a wax myrtle along Kenta Canal. This snake is probably common along any brushy habitat which borders an open area.

ABUNDANCE AND HABITS: Disposition: non-venomous, docile, rarely bites. Strictly diurnal. Arboreal, occasionally terrestrial. Green snakes are known for their climbing ability, where they catch insects with the aid of their acute vision. Commonly found in vegetation and trees overhanging water. Lays eggs.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	LOW
DRIFT FENCE	----
MINNOW TRAPS	----
COVERBOARDS	----

COMMENTS: One of the least frequently encountered snakes at JELA. Only one individual was found, at Kenta Canal. NPS personnel report finding snakes around the visitor center. Long term studies of this species have shown that their population size is linked to drought. This is probably because their primary prey, larvae of flying insects, become less common during drought periods. Because our survey took place after a long and harsh drought, this could explain the relative “uncommonness” of this species.

Brown Snake (*Storeria dekayi*)

DESCRIPTION: a small (up to 1 ft.) snake, with a light brown ground color and two parallel rows of black spots down the back. Belly usually plain. Small, dark longitudinal line behind the eye. See Conant and Collins (1991; plate 22, pp. 161).

SIMILAR SPECIES: No snake found at JELA closely resembles the brown snake. However, this species can be easily confused with red-bellied snakes (*Storeria occipitomaculata*), which may occur at this site. Brown snakes lack any bright pigment on their belly (red-bellied snakes will have bright red bellies).

HABITATS FOUND: Commonly found in the Hardwood and Cypress Tupelo habitats, one individual found in the Marsh.

ABUNDANCE AND HABITS: Disposition: non-venomous, docile, seldom bites. Diurnal and nocturnal. Terrestrial. A common snake in most parts of its range, the brown snake is often found in gardens around houses, and is particularly conspicuous after heavy rains. Feeds on snails, which it extracts from their shells with specialized teeth and jaw adaptations. Gives birth to live young.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	LOW
ROAD	LOW
MINNOW TRAPS	-----
COVERBOARDS	LOW

COMMENTS: An infrequently observed snake, but probably more common than our survey suggests. In part, this may be because of its wide use of micro- and macro-habitats: we found one individual inside of a log and another individual under a coverboard in the heart of the marsh.

Western Ribbon Snake (*Thamnophis proximus*)

DESCRIPTION: a slender, medium-sized snake (up to 3 ft. in total length), with a longitudinal light stripe down the middle of the back, and a light stripe along each side of the body. Side stripes are found on scale rows 3 and 4. Variable in color; ground color usually black or dark, with various light markings along the sides. The stripe usually orange, but can be yellow or green. See Conant and Collins (1991; plate 23, pp. 172).

SIMILAR SPECIES: Garter snakes (*Thamnophis sirtalis*) are similarly marked, but are thicker, and the stripe on the side of the body is on scale rows 2 and 3, rather than on 3 and 4. Additionally, most garter snakes at JELA will have a greenish stripe.

HABITATS FOUND: Found throughout the Preserve.

ABUNDANCE AND HABITS: Disposition: non-venomous, usually docile, seldom bites. Generally diurnal, but can be found active at night. Terrestrial to semi-arboreal. Ribbon snakes inhabit many different habitats, and are fond of wet areas, where they feed mainly on frogs. Gives birth to live young.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	HIGH
ROAD	MODERATE
MINNOW TRAPS	-----
COVERBOARDS	MODERATE

COMMENTS: The most abundant snake at JELA. This species can be most easily observed by canoeing down any waterway in the Preserve. During late April and early May, female snakes can be found in this fashion and are generally associated with two or more male ribbon snakes. While mating was not observed, presumably courtship was taking place.

Common Garter Snake (*Thamnophis sirtalis*)

DESCRIPTION: a medium-sized snake (up to 3 ft. in total length), with a longitudinal light stripe down the middle of the back, and a light stripe along each side of the body. Variable in color; ground color usually black or dark, with various light greenish markings along the sides. At JELA, the stripe usually greenish, but can be yellow. See Conant and Collins (1991; plate 23, pp. 165).

SIMILAR SPECIES: Ribbon snakes (*Thamnophis sauritus*) are similarly marked, but are more slender, and the stripe on the side of the body is on scale rows 3 and 4, rather than on 2 and 3. Additionally, at JELA, the stripes of ribbon snakes are almost always orange, while the stripes of garter snakes are generally green.

HABITATS FOUND: Found in the Hardwood forest habitat.

ABUNDANCE AND HABITS: Disposition: non-venomous, but are aggressive (at other sites, they are more docile). Chiefly diurnal. Terrestrial. Garter snakes inhabit many different habitats, where they feed on earthworms, frogs, insects, and mice. Gives birth to live young.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	LOW
ROAD	----
MINNOW TRAPS	----
COVERBOARDS	----

COMMENTS: Our general impression of this snake in Louisiana is that it is a relatively uncommon snake, and our data from JELA appear to confirm this finding. Worth noting is that all three snakes we found were within 200 meters of the Education Center building.

Glossy crawfish snake (*Regina rigida*)

DESCRIPTION: a small snake (generally 1-2ft in total length). Dorsum is generally dark olive green, brown or purplish and *shiny*. Venter is an orangish- peach hue, with *two rows of dark dots* extending down to the vent, and fusing to one row for the entire length of the tail. Head is bi-colored, with top being the dark olive brown, and orange extending up to the lips of the animal. Occasional specimens may have light stripes running down dorsum, but the (few) individuals found at JELA were uniformly dark. See Conant and Collins, 1991 (plate 22, p. 158).

SIMILAR SPECIES: Several water snakes have relatively dark dorsums, and live in similar habitats, but none appear glossy *when dry*, and none have an orange belly with two rows of dark spots down the sides. The Graham's crawfish snake (*R. grahami*) was not discovered during our surveys at JELA, but may be a resident. It can be distinguished by being more dull, brown, with light tan stripes on the side, and a plain belly or tan belly with a *single* row of dark spots.

HABITATS FOUND: Found in the Hardwood forest habitat.

ABUNDANCE AND HABITS: Disposition: non-venomous, and generally very docile. Apparently primarily nocturnal, but rarely seen. Almost entirely aquatic, nearly every record (save one) of glossy crawfish snakes is associated with an aquatic habitat. Feed primarily on crawfish, but also fish and frogs. Gives birth to live young.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	----
ROAD	LOW
MINNOW TRAPS	LOW
COVERBOARDS	----

COMMENTS: Two individuals were found during the course of our studies. One was captured in a minnow trap in a pond at the end of Wood duck trail. The other was found crossing Hwy 45 near Twin Canals, apparently coming from a vernal pool that is located there.

SPECIES OF POSSIBLE OCCURANCE

Bullfrog (*Rana catesbeiana*)

DESCRIPTION: A large (ca. 3.5-6 in.) frog. Dorsal coloration is plain olive green, sometimes with mottling. Venter generally whitish with variable “wormlike” markings. Skin is smooth, no toe pads, but extensive webbing between the toes. See Conant and Collins (1991; plate 48, pp. 335).

SIMILAR SPECIES: Most similar are green frogs and pig frogs. Green frogs have a pair of distinct dorsolateral ridges which run from the tympanum to the groin, bullfrogs and pig frogs do not. Additionally, on the hind feet of pig frogs, the webbing runs nearly to the tip of the 4th toe, whereas in the bullfrog a portion of the 4th toe is unwebbed (however, there is significant variation in this trait in pig frogs at JELA, and so caution must be exercised). Additionally, pig frogs at JELA generally have a pair of brown or green stripes running down their back (which would presumably be absent on the bullfrog). Perhaps the most diagnostic character is the call. Pig frogs exhibit a series of short grunts (at JELA, generally three grunts). The bullfrog gives a much more drawn out groan (and generally only one at a time).

HABITATS FOUND: NOT FOUND AT JELA during the course of our studies, however, Rossman and Demastes, 1991 stated that they heard a lone bullfrog calling from the waters surrounding the Ring Levee.

VOICE: A long groan. Several field guides give the bullfrogs call as “Jug-o-rum”, and apparently, in Louisiana this has just been shortened to “rum”.

ABUNDANCE AND HABITS: Nocturnal, but can be heard calling at any hour of the day, most commonly in the evening.

<u>LIKELY TO BE ENCOUNTERED USING:</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	HIGH
MINNOW TRAPS	MODERATE
VOICE	HIGH
COVERBOARD	----
ROAD	----

COMMENTS: Despite its relative ease of detection at many sites throughout the United States (they are a large frog, easy to spot, and have a booming voice), our study failed to document the presence of this animal at JELA. While bullfrogs have apparently never been very common at JELA (D. Muth, pers. comm.), it is still rather surprising that our surveys failed to turn up even a single individual. Future calling surveys should be conducted at regular intervals to ascertain the status of this frog within the Preserve.

Broad-headed Skink (*Eumeces laticeps*)

DESCRIPTION: a large stout skink (up to 1 ft. total length). Sexes differ in appearance: adult males may have faint stripes on a gray, brown, or gold dorsum, and a red or orange head, which is much wider than the body. Females are striped and have a blue tail, which fades in older specimens, and lack the broad head. Juveniles resemble adult females, but are more brilliantly colored. Belly white or cream. See Conant and Collins (1991; plate 19, pp. 130).

SIMILAR SPECIES: Ground skinks are also much smaller, and have small heads and tiny legs.

HABITATS FOUND:

ABUNDANCE AND HABITS: Disposition: aggressive, often bites. Arboreal and terrestrial. These skinks do much of their foraging along the ground. They prefer habitats with oak trees and leaf litter. They eat insects, as well as other skinks and lizards. Like all other lizards, the tail breaks easily. Lays eggs.

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	HIGH
DRIFT FENCE	----
COVERBOARDS	HIGH

CAPTURE SUMMARY: Broad-headed skinks were found to be very common at Naval Live Oaks, but only in areas with dense oaks, such as the Visitor Array site and the Beaver Pond site. At those sites we caught many by hand, but the best sampling method was coverboards. At Fort Pickens, we found only one individual, a male, that was on the base of a tree near the Nature Trail boardwalk. We observed a male attempt to eat a ground skink at the Beaver Pond site. The broad-headed skink seized the ground skink by the tail, which promptly broke, and the ground skink escaped.

Red-bellied Snake (*Storeria occipitomaculata*) POSSIBLE OCCURANCE?

DESCRIPTION: a small (< 1 ft. in total length) snake, with a variety of color phases, even within a population. The individuals we found were pine-straw colored, but other known colors are black, gray, brown, or tan. Belly usually red or orange but often black, yellow, or cream colored. Three light spots on top of neck. See Conant and Collins (1991; plate 22, pp. 163).

SIMILAR SPECIES: The brown snake (*Storeria dekayi*) has a plain belly.

HABITATS FOUND: NOT OBSERVED AT JELA.

ABUNDANCE AND HABITS: Disposition: non-venomous, docile, seldom bites. Diurnal and nocturnal. Terrestrial and fossorial. A common snake in some portions of the range; rare in other areas. Secretive, seldom seen active. Presumably feeds on insects and snails. Gives birth to live young

<u>METHODS OF CAPTURE/DETECTION</u>	<u>RELATIVE EFFECTIVENESS</u>
HAND	-----
ROAD	-----
MINNOW TRAPS	-----
COVERBOARDS	-----

COMMENTS: D. Muth (pers. comm.) cites an observation by a reputable zoo herpetologist who found a red-bellied snake within the Preserve. However, there are relatively few records of red-bellied snakes from the Mississippi river bottoms in Louisiana (and most records are from piney- woods similar to Tunica Hills). Additionally, the closest records for this species are along the Mississippi in Baton Rouge. However, because of its secretive nature, there is a possibility that they may be found at JELA, and any light brown snakes with red bellies found should be photographed and/or collected for verification by a herpetologist.